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Briggs & Stratton Tracking Program

We need your help. Our goal is to provide the best quality training available to meet your specific needs. Please take a few moments to complete this survey.

Today's Date: _____/ _____/ _____ CSSD Number: ___ ___ ___ ___
Month Day Year

Participant Information

What is your age?_____

How many technicians work at your facility? _____ (number)

How many years have you been in this industry?_____

Which of the following best describes your position? (check only one)

❑ Both Owner & Technician ❑ Technician ❑ Owner ❑ Mass Merchandiser
❑ Vocational Teacher ❑ Student ❑ OEM ❑ Other: _____

Ratings

Which section of the Update Seminar did you find most valuable? (check all that apply)

❑ Technically Speaking ❑ Service Tips & Tools ❑ New Engine Features
❑ Service Tools ❑ A Closer Look ❑ Service Department
❑ New Products ❑ Governor ❑ Sneak Preview

Please rate your satisfaction with the 2002 Technical Update Seminar in the following areas. Rate each area from 1 to 5, with 1 being Poor and 5 being Excellent.

	1-Poor		3-Average		5-Excellent
Update Content	❑	❑	❑	❑	❑
Update Location	❑	❑	❑	❑	❑
Time of Day Offered	❑	❑	❑	❑	❑
Update Instructor	❑	❑	❑	❑	❑
Update Facilities (rooms, equipment, etc.)	❑	❑	❑	❑	❑

Computer Access

Do you have a computer in your home? ❑ Yes ❑ No

Does your shop or business have a computer? ❑ Yes ❑ No

Is your shop or home computer equipped with DVD? ❑ Yes ❑ No

Is your computer in the shop for technicians to use? ❑ Yes ❑ No

What is your computer currently used for (check all that apply)? ❑ Troubleshooting engines/equipment
❑ Technicians looking up parts (IPL's) for engines/equipment ❑ Other _____

Would you like to see more of Briggs & Stratton's technical and service information available in a computer format?

❑ Yes ❑ No ❑ Don't Know

Do you have any additional comments you would like to pass along?_____

_____

_____

Thank you for taking the time to complete our survey. Your comments will help improve Briggs & Stratton training in the future.

Please see next page for Video Capsule Survey

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2002 Technical Update Seminar Video Survey

Our goal is to provide the best quality training available to meet your specific needs. Please take a few moments to **complete this survey** and **return it to your Central Sales and Service Distributor, Attn. Educational Director.** Doing so will insure proper credit is received for attendance.

CSSD Number: ___ ___ ___ ___

Participant Information

Name: _____ MST ID#: _____

Home Address (Optional): _____

City: _____ State: _____ Zip: _____

E-mail Address: _____

Dealer Information

Dealer Name: _____ B&S ID#: _____

Business Address: _____

City: _____ State: _____ Zip: _____

E-mail Address: _____

1) What is the plating on the piston for the new Fource™ engine?

_____

2) Does the polymer assembly plug on the link assembly need to be replaced when re-assembling the new AVS™ engine? (Y or N)

_____

3) What is the projected brush life of the new Etek™ electric motor when used continuously at 65 amps?

_____

4) What is the part number for the new c-ring removal tool listed this year?

_____

5) What size bottle does the new 5W30 synthetic oil come in?

_____

6) What is the major change to the model 9 (90000) series vertical shaft engine this year?

_____

7) How many screws need to be removed in order to separate the two housing halves on the new Fource™ engine?

_____

8) Can the fastener for the Fource™ rewind pulley be reused? (Y or N)

_____

9) What is the part number for the new Poster Kit?

_____

10) Is the Time Analysis Repair Guide featured in Service Bulletin #691 a flat rate guide? (Y or N)

_____

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2002 TECHNICAL UPDATE SEMINAR

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- 2 L/C Vanguard™ Engine
- Intek™ Model 210000 & 310000 Anti-Vibration System Engine
- Etek™ Electric Motor

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- Master Parts Pro
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- Briggs & Stratton 5 HP Outboard Motor

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TECHNICALLY SPEAKING

FOURCE™ ENGINE MODEL 21032-0111-E1

The Fource™ engine is a new 2 cubic inch (32.77 cc), 4 cycle L-head engine aimed at the string trimmer market. This 4-cycle engine meets the 2005 emission standard set by the EPA for the 2-cycle engine industry. The cylinder bore is aluminum with a bore of 1.58” (40.132 mm) and a stroke of 1.07” (27.178 mm).

Description	**Model 21032-0111-E1**
Rated	0.75 hp (559.27 watt)
Torque	.75 ft. lbs. (1.02 Nm) @ 6200 rpm
Displacement	2.075 cu. in. (34 cc)
Valve Design	L-head
Cylinder	Aluminum
Bore	1.58” (40.132 mm)
Stroke	1.07” (27.178 mm)
Bore Type	Kool Bore™
Governor	External load
Ignition	Electronic
Air Cleaner	Oiled foam filter
Lubrication	Pulse/splash lube
Emissions	Exceeds EPA standards through the year 2005
Controls	Remote throttle control
Bearings	Dual ball bearings – magneto side
Fuel Tank	10 fl oz. (298 ml)
Piston	Nickel coated aluminum piston
Muffler	Lo-tone
Fuel Filter	In-line filter only
Oil Capacity	2.67 oz. (0.079 liters)
Oil Type	SAE 30 W
Stop Switch	Momentary rocker stop switch
Rewind	Integral to outside housing
Carburetor	Rotary valve carburetor 8mm Venturi – Walbro
Comp. Ratio	6.5:1

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2 L/C VANGUARD™ ENGINE

Description	Model 470000
Rated	27 hp (20.13 kw)
Torque	40 ft. lbs. (54.23 Nm) @ 2200
Displacement	46 cu. in. (754 cc)
Valve Design	Overhead valve
Cylinder	Aluminum
Bore	3.19” (81.026 mm)
Stroke	2.87” (72.898 mm)
Bore Type	Dura Bore™, cast iron sleeve
Governor	Mechanical
Ignition	Magnetron®
Air Cleaner	Cyclonic A/C with paper element
Lubrication	Pressure lube
Emissions	Meets EPA standards
Controls	3 in 1 manual
Bearings	Plain magneto – plain PTO (steel backed aluminum inserts)
Piston	Low – mass piston
Muffler	5” (127 mm) round muffler
Fuel Filter	In-line 150 Micron fuel filter, 75 Micron fuel filter w/fuel pump
Oil Fill	High oil fill (valve cover)
Rewind	N/A
Carburetor	2 barrel, 21 mm Venturi
Comp. Ratio	8.4:1

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INTEK™ MODEL 210000 & 310000 ANTI VIBRATION SYSTEM ENGINE

The highlight of these 21 & 31 cubic inch displacement vertical shaft Intek™ engines is the new Anti-Vibration System (AVS™). This patented, linear balance counterweight system, is a "clean sheet of paper" design addressing all aspects of engine balance.

Features include: Linear balance counterweights, computer optimized crankshaft balance, low mass piston and dynamically balanced flywheel.

All in all, the engine balance package reduces vibration to less than 0.5 (g's) at 3600 rpm no-load.

Description/Model	Model 210000 Intek™ OHV	Model 310000 Intek™ OHV
Rated	13-13.5 hp (9.1 kw – 10.1 kw)	15-17.5 hp (11.2 kw – 13 kw)
Torque	16.8 ft. lbs. (22.77 Nm)	28.5 ft. lbs. (38.64 Nm)
Displacement	21.05 cu. in. (344 cc)	30.59 cu. in. (501 cc)
Valve Design	Overhead valve	Overhead valve
Cylinder	Aluminum	Aluminum
Bore	3.438" (87.32 mm)	3.563" (90.50 mm)
Stroke	2.266" (57.55 mm)	3.063" (77.8 mm)
Bore Type	Dura-Bore™, cast iron sleeve	Dura-Bore™, cast iron sleeve
Governor	Mechanical	Mechanical
Ignition	Magnetron®	Magnetron®
Air Cleaner	Reverse flow panel A/C paper element with foam pre-cleaner	Reverse flow panel A/C paper element with foam pre-cleaner
Lubrication	Slinger/optional pressure lube and full pressure lube	Slinger/optional pressure lube and full pressure lube
Emissions	Meets EPA standards	Meets EPA standards
Controls	3 in 1 manual/fixed speed/remote	3 in 1 manual/fixed speed/remote
Bearings	plain magneto – DU PTO	DU magneto – DU PTO
Piston	Low – mass piston	Low – mass piston
Muffler	Optional square Lo-tone and performance mufflers	Optional square Lo-tone and performance mufflers
Fuel Filter	In-line 150 Micron fuel filter 75 Micron fuel filter w/fuel pump	In-line 150 Micron fuel filter 75 Micron fuel filter w/fuel pump
Oil Fill	High oil fill	High oil fill
Rewind	N/A	N/A
Carburetor	5/8" Venturi	3/4" Venturi
Comp. Ratio	8.0:1	8.0:1

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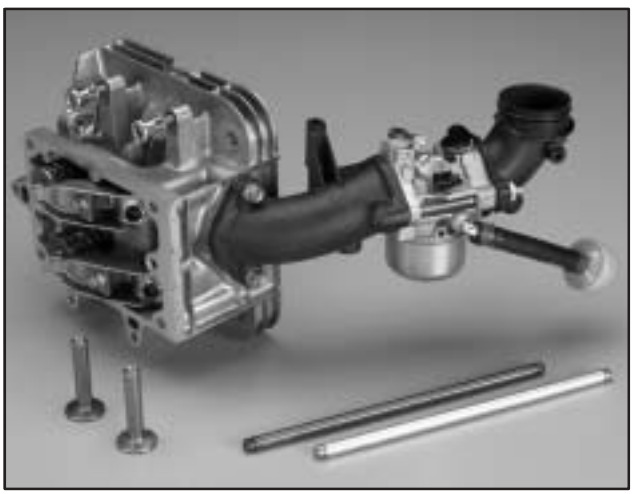
DIPSTICK TUBE

The injection molded dipstick tube is designed to accommodate a voltage regulator for those applications that require one. If equipped, the regulator must use a grounding strap to insure a positive contact with the engine block.

INNOVATIVE AIR INTAKE SYSTEM

This new engine series offers OEMs and consumers both a low, sleek profile accomplished by creative changes to the air intake system. The polymer blower housing does double duty as the air filter chamber. Intake air is pulled from the blower housing, passed through a foam pre-cleaner and a pleated paper cartridge before it passes from the housing to the intake manifold. The polymer intake manifold seals to the blower housing via an o-ring. The paper cartridge is a reverse flow type so make sure your customers are aware of the proper maintenance procedures.



Another handy feature for the service technician are slots on the blower housing that allow removal simply by loosening the screws and sliding the housing off.

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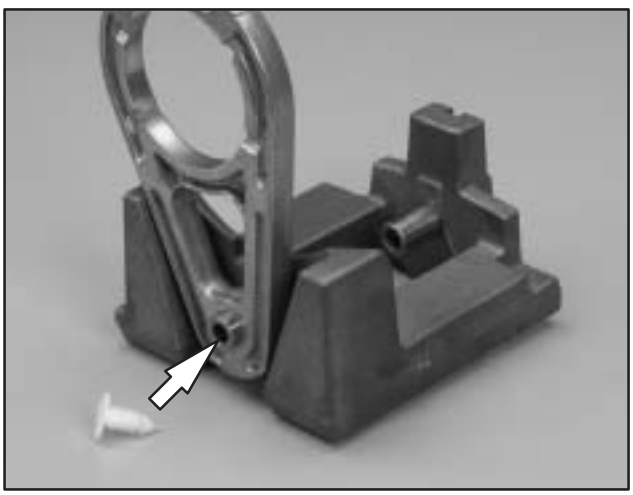
POLYMER RETAINING PLUG

Just so you know, a polymer plug is used to facilitate the assembly process of the aluminum links and the counterweight. Its only function is to hold the pieces together as they move down the assembly line and serves no purpose in the actual operation of the engine. It is not listed on the illustrated parts lists and can be discarded by the service technician.

POLYMER PLUG LOCATION

The polymer plug is installed on one side of the aluminum link during engine assembly.



NEW ENGINE BASE

This new engine base accommodates the linear action of the Anti-Vibration System.

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ETEK™ ELECTRIC MOTOR

Technically known as an axial air gap direct current disc armature motor, the Briggs & Stratton Etek™ electric motor is a real powerhouse with the following impressive list of features.

High torque at high efficiencies, minimal loss of speed as motor is loaded. Simple control with speed proportional to voltage, integral commutator, regenerative braking, low torque ripple, low inductance for instantaneous torque, self regulating maximum speed, 50% smaller and 20 lbs. (9.07 kg) lighter than comparable motors.

Description	**Etek™**
Maximum Rated Motor Output	15 hp (11.2 kw)
Typical Continuous Rated hp	8 hp (5.97 kw)
Torque Constant	15 hp 1.14 in. lbs./amp (0.13 Nm/amp)
Motor Weight	21 lbs. (9.52 kg)
Maximum Motor Current	330 amps for 2 minutes
Voltage Constant	72 rpm per volt
Maximum Voltage	50 vdc
Typical Battery Voltage	12 to 48 vdc
Maximum No-load Speed	3600 rpm
Minimum No-load Speed	3300 rpm
Minimum Speed at 160 in. lbs. of Torque	3200 rpm
Maximum Continuous Current at 160 in. lbs. of Torque	140 amps
Maximum No-load Current	6 amps
Bearings	Ball bearings
Warranty	1 year from purchase date
Brush Life Expectancy	
@65 Amps Continuous	3000 hours
@100 Amps Continuous	2000 hours
@150 Amps Continuous	1000 hours

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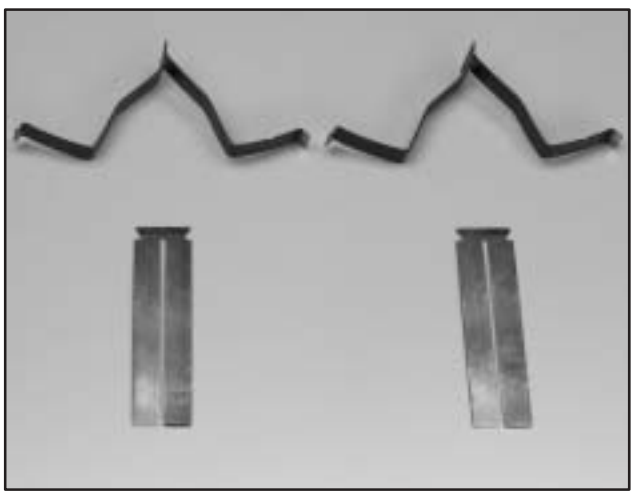
INTEGRAL COMMUTATOR TECHNOLOGY

The armature rotor uses solid copper conductors known as buss bars rather than the conventional copper wire windings. These buss bars have very low resistance, resulting in less heat build up and higher energy efficiency in the rotor.

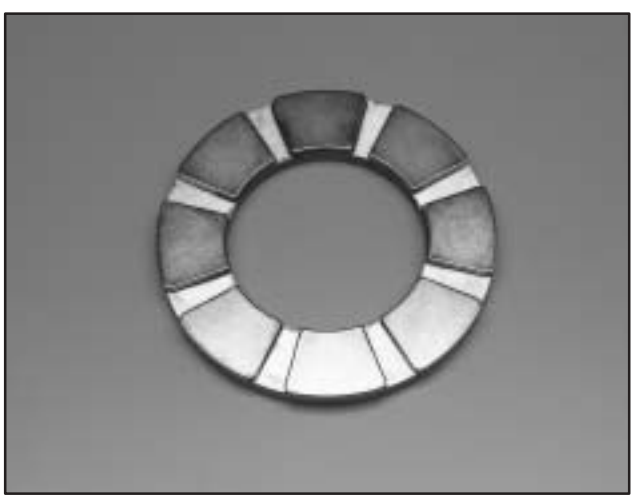
COPPER BUSS BARS

The buss bars are stamped, formed and coated before assembly on the rotor.



NEODYMIUM MAGNET TECHNOLOGY

Briggs & Stratton Etek™ motors use neodymium permanent magnets. Each ring has eight magnets that equal 1000 lbs. (453.6 kg) of head on force. Sixteen magnets are used – eight on each side of the rotor. These magnets generate so much force, that the motor is not even bolted together. In fact, a press is required to take it apart.



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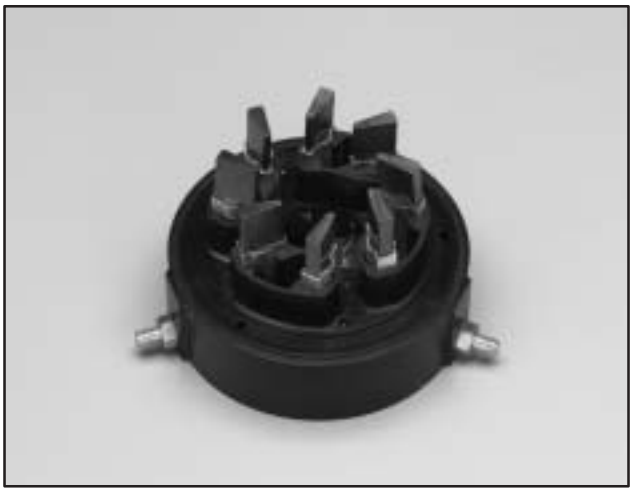
SERVICEABLE BRUSH HOLDER

There are eight brushes on an easily serviced brush holder assembly. Should brush service ever be necessary, it can be performed virtually in a matter of minutes.



VERSATILITY IS THE KEY

The Etek™ motor offers a variety of center shafts to allow adaptation to many different types of equipment. Power can be anywhere from 12 to 48 volts direct current. The open frame motor handles 140 amps continuous and 330 amps for up to two minutes. Rotational speed is 72 rpm per volt.

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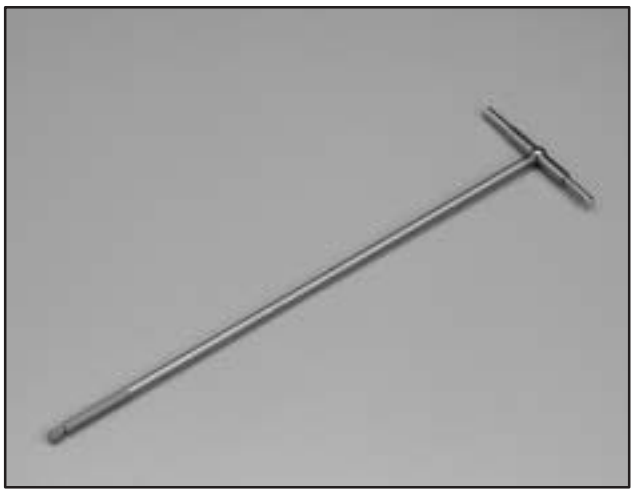
SERVICE TOOLS

19485 TELESCOPING GAUGE

The 19485 telescoping gauge can reach the bottom of even the deepest cylinder bores. The handle is 12" (304 mm) long and the telescoping gauge has a range of 2" to 3½" (51 mm to 89 mm).



19493 MITY-VAC PRESSURE/VACUUM GAUGE

Here is an inexpensive but valuable tool for the modern day technician. As a pressure gauge, the 19493 can be used to check inlet needle and seats for leakage as well as porosity in carburetor bodies. On the vacuum side, the 3 L/C gasoline engine requires it for checking choke dashpot pull off.

TORQUX STAR BITS

Many technicians have asked to purchase replacement bits for our 19442 Torqux set. The following are the size and part number for these individual bits.

19510 – T-10	19513 – T-27
19511 – T-15	19514 – T-30
19512 – T-20	19515 – T-40
19482 – T-25	19516 – T-45

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19499 INDUCTIVE CURRENT CLAMP MULTIMETER ACCESSORY

Anytime a diagnostic tool simplifies testing it increases the likelihood that the test will be performed. It also increases the speed and confidence at which the test is performed. The 19499 Fluke Inductive Current Clamp does simplify alternator and starter motor testing. To use the current clamp, simply turn on the meter to the millivolt scale, plug the current clamp into the meter, set the calibration to zero and clamp the tool over any wire on the engine or piece of equipment. Using this tool eliminates the need to install the DC shunt thus saving additional time.

19495 DIGITAL CRANKCASE VACUUM TESTER

Here is a simple tool used to obtain precise crankcase vacuum readings. Attach the tool and start the engine. Run at top no load speed until normal operating temperature is reached and turn on the gauge to take your reading. Check out our Service Tips and Tools section to see how to make adapters for attaching the tester to an engine.

19522 C-RING REMOVAL TOOL

Many of you have said that removing the c-ring, which secures the starter motor drive, can be difficult. With this in mind we'd like to introduce part number 19522, an improved c-ring removal tool for all models of Briggs & Stratton starter motors.

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19487 DIAL BORE GAUGE

Accurately checking the cylinder bore for out-of-round, taper and reject size is now an easy thing to do with the 19487 Dial Bore Gauge. The gauge comes complete with anvils and spacers to measure cylinder bores from 2” – 6” (50.8 mm – 152.4 mm)

19524 T30 TAMPER PROOF TORX BIT

One of the fasteners securing the Touch-N-Mow™ starter system to our engines is of a tamper proof design. To remove this fastener quickly requires the use of the 19524 T30 Tamper Proof Torx Bit. The bit has a provision for the interference pin on the fastener.

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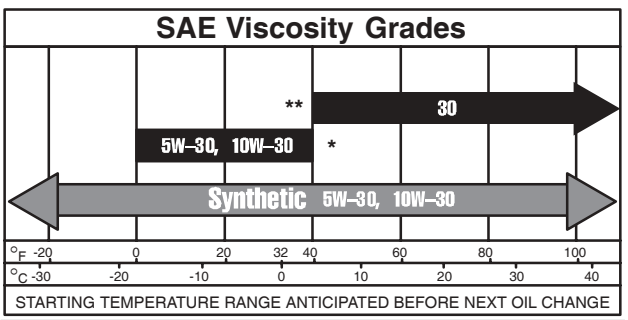
NEW PRODUCTS

100074 100% SYNTHETIC OIL

During the 2000 Technical Update Seminar we told you that the use of synthetic oil was approved for use in Briggs & Stratton engines. This year we're introducing part number 100074, a multi viscosity, 100% synthetic motor oil, SAE 5W-30. This product meets Society of Automotive Engineers (SAE) viscosity and American Petroleum Institute (API) service specifications and exceeds lubrication requirements for Briggs & Stratton engines. The lubricant is bottled in 32 oz. (946 ml) containers and packed 12 to a case.


SAE Viscosity Grades
**
30
5W–30, 10W–30
*
Synthetic 5W–30, 10W–30
°F -20 0 20 32 40 60 80 100
°C -30 -20 -10 0 10 20 30 40
STARTING TEMPERATURE RANGE ANTICIPATED BEFORE NEXT OIL CHANGE

* **CAUTION:** Air cooled engines run hotter than automotive engines. The use of non-synthetic multi-viscosity oils (5W-30, 10W-30, etc.) in temperatures above 40°F (4°C) will result in higher than normal oil consumption. When using a multi-viscosity oil, check oil level more frequently.

** **CAUTION:** SAE 30 oil, if used below 40°F (4°C), will result in hard starting and possible engine bore damage due to inadequate lubrication.

Note: Synthetic oil meeting ILSAC GF-2, API certification mark and API service symbol (shown at left) with "SJ/CF ENERGY CONSERVING" or higher, is an acceptable oil at all temperatures. **Use of synthetic oil does not alter required oil change intervals.**

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The Briggs & Stratton Engine Minder is designed to prompt consumers to perform recommended maintenance on their Briggs & Stratton engine.

How It Works

The primary side of the engine magneto powers the Engine Minder's microprocessor; a 12V battery is not required. When the engine has run for 50 hours, the "Change Oil" symbol will "flash" indicating that recommended maintenance is required. After 100 hours, the "Change Air Filter" symbol will "flash".

Pressing the reset button will reset the clock but only for a light that is "flashing".

Note: If the ignition key is left in the "on" position and the engine is not running no time will be recorded.

The Engine Minder is designed to withstand severe environments including snow and rain, and the warning lights are visible in sunlight.

All Engine Minders are 100% inspected and tested prior to shipment. Initial production will be OEM installed (lawn tractors).

NOTES

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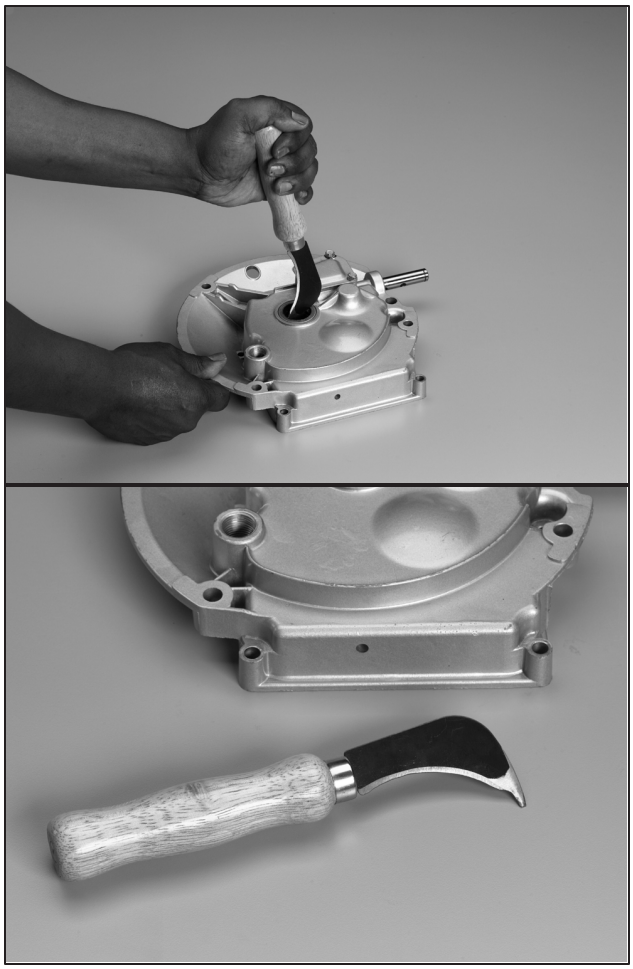
SERVICE TIPS & TOOLS

SEAL REMOVAL TOOL

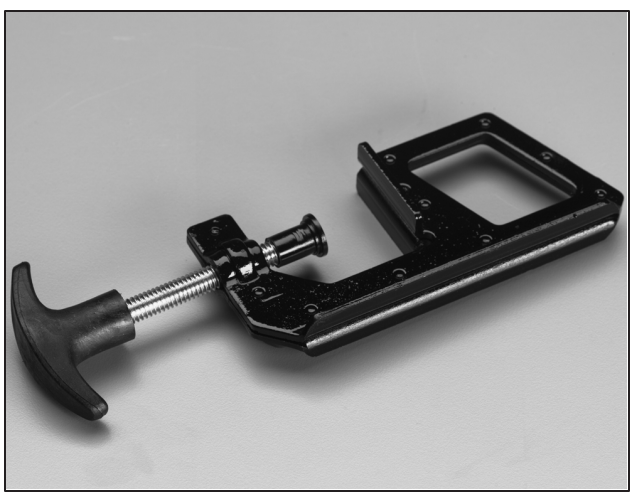
Dave Vance, a Master Service Technician from Trempealeau, WI has found that by modifying a linoleum knife he could easily remove an oil seal from an engine. Use a grinder to shape one end of the cutter and remove sharp edges, then just hook the tool behind the seal and rock it.

Caution: Care should be taken so that the tip of the tool does not damage the seal bore.



BLADE HOLDER FOR LEAKDOWN TEST

Remember the last time you used your 19475 Leakdown Tester on a rotary lawn mower? You probably had a tough time holding the piston at Top Dead Center while performing the test. To assist with holding the piston we'd like to suggest an inexpensive blade holder. These are available locally to lock the blade in place and will keep your free hand away from the blade.



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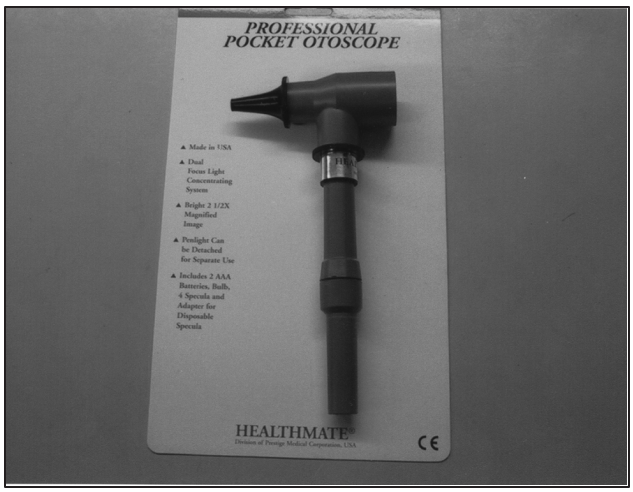
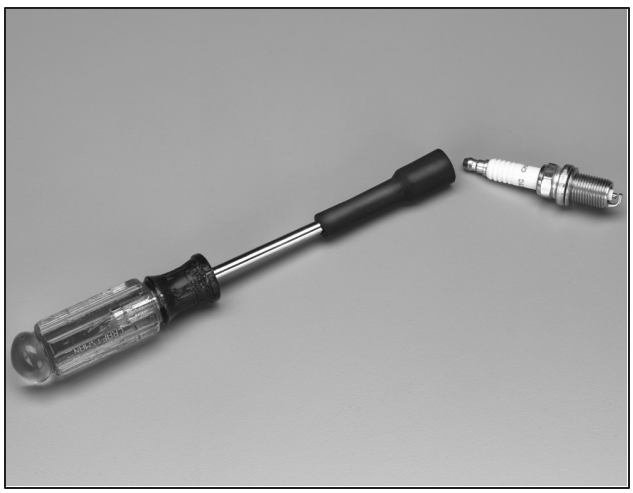
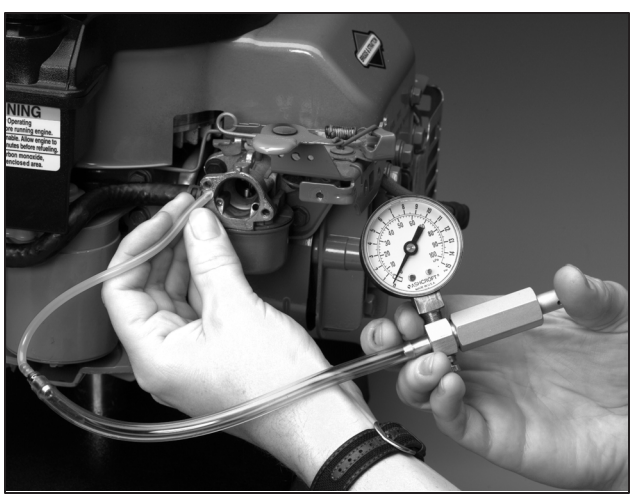
Brent Allen, a Master Service Technician from George West, Texas suggests purchasing a pocket otoscope to enhance visibility of carburetor circuits. This idea provides another way for technicians to see deep inside non-removable carburetor passageways.



Jason Welch, of Fall River, Massachusetts found that installing an old rubber spark plug boot over the end of a #2 Phillips Screwdriver enabled him to easily install a spark plug that is recessed in the cylinder head. This tool also works well on engines with the spark plug located under the fuel tank.



Have you ever had to troubleshoot an LMS carburetor with primer on an engine that is hard starting and found the primer doesn't work? Or, how about after removing the same carburetor you can't find any reason for the problem? Larry Schneider, a Master Service Technician from Arlington, Texas has come up with an idea using a carburetor thumb pump to check the primer before removing the carburetor from the engine. He simply connects a small piece of fuel line or a tapered adapter to the pump. Then after removing the air cleaner base, simply insert the tool into the carburetor primer passageway and apply pressure. If the primer originally failed to operate with the primer bulb but passes this test, then the problem must involve the base, the gasket or the bulb.



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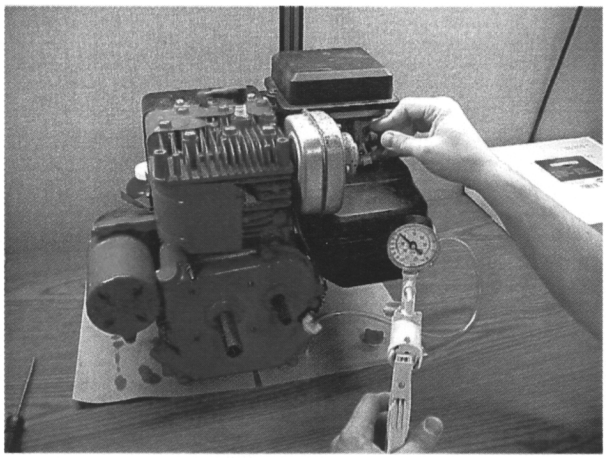

Fig.-1

Fig.-2

Fig.-3

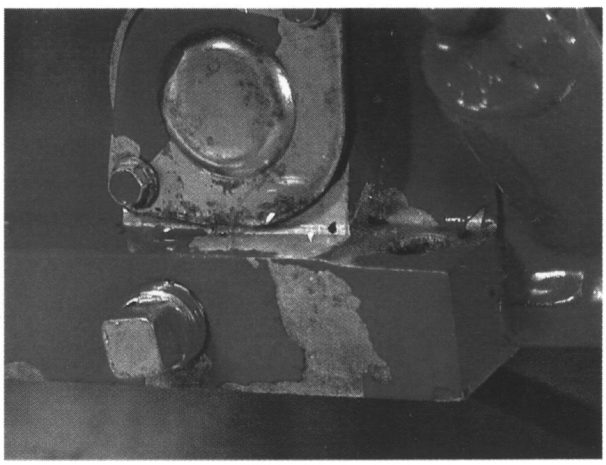

Fig.-4

Aaron Gray, a Master Service Technician and a Master Parts Pro from Columbus, OH came up with the following idea for checking an engine for leaky gaskets or porosity. Drain the oil and install a modified oil fill cap. Attach the 19493 Mity Vac Pressure/Vacuum Pump to the fill cap and while pinching off the breather tube apply pressure with the pump. Window cleaner, soapy water or bubble solution can be sprayed on the engine to quickly find the leak or porosity.

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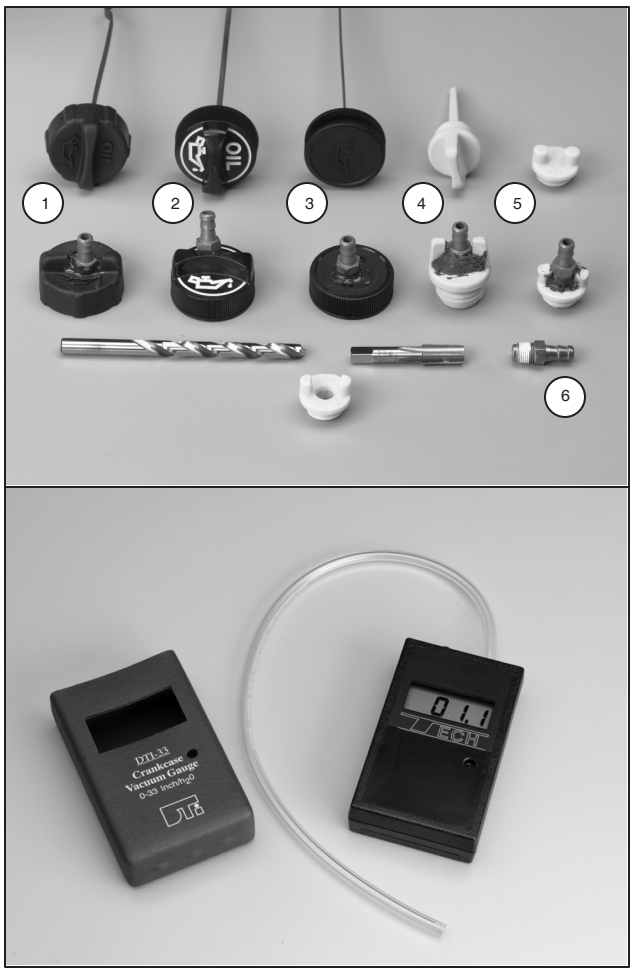
ENGINE TEST FITTINGS

This year we've given you a few new tips to check engines for porosity and leaks and introduced the new digital crankcase vacuum gauge you saw earlier. What you need now is a quick and easy way to firmly attach these tools to an engine's crankcase. All you need to do is gather an assortment of various engine fill caps and dipsticks and an equal number of 691764 barbed fuel fittings. Listed below is an assortment of dipstick and fill cap part numbers.

First, if using a dipstick remove it from the cap. Determine the best location to drill a hole using a letter "Q" drill bit. Since you're working with plastic, it may also be possible to use a 21/64" or 5/16" bit too. Next, tap the hole with a 1/8" NPT tap, install the barb, epoxy in place and you're finished.

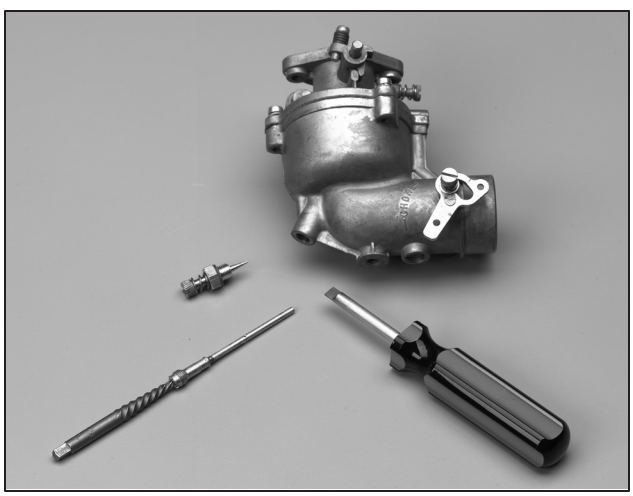
Part Number:

1 – 495264 Dipstick
2 – 807985 Dipstick
3 – 495230 Dipstick
4 – 715588 Dipstick
5 – 281658 Fill Cap
6 – 691764 Hose Connector



REMOVING FROZEN EMULSION TUBES

Our last Service Tip and Tool comes from Hastings, Michigan. Twelve-year-old Peter Feldpausch submitted this often practiced but never publicized suggestion for removing the emulsion tubes that can become frozen in flo-jet carburetors. Carefully drill a hole into the emulsion tube and use a Number 2 Screw Extractor to loosen it. After the tube is removed he further suggests using the appropriate tap from the 19245 Carburetor Tap Set to clean the threads before reinstalling the replacement tube. Thanks Peter!



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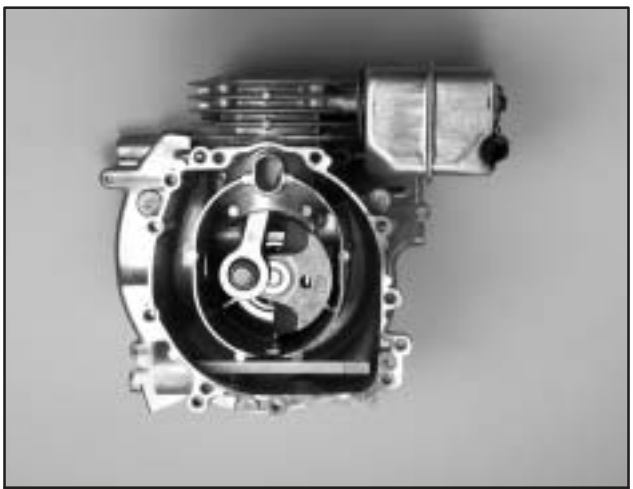
A CLOSER LOOK – FOURCE™ ENGINE

The Fource™ engine uses a spring loaded rocker switch and a maintenance free electronic ignition module.

The connecting rod is a stamped aluminum one-piece assembly using needle bearings at both the piston pin and rod journal. Piston is a cast, nickel plated, symmetrical style with three rings.

Crankshaft is an open, cantilever type, supported by two main ball bearings. The exhaust and intake valve clearance is .002" – .004" (.0508 mm – .1016 mm). Engine speed is held down by load. If load is insufficient to keep speed down, over speed protection occurs from valve float.



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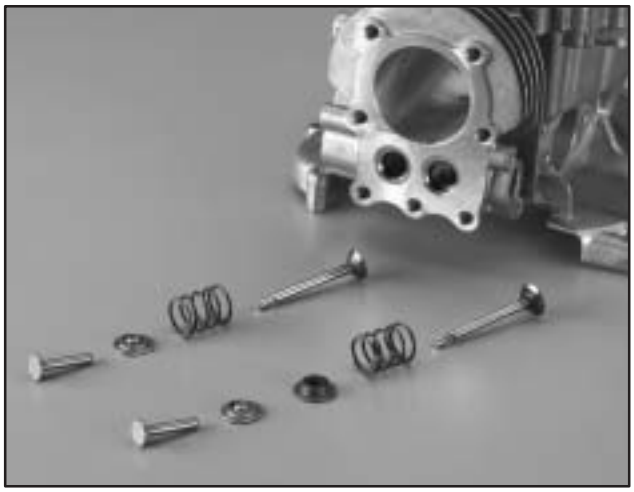
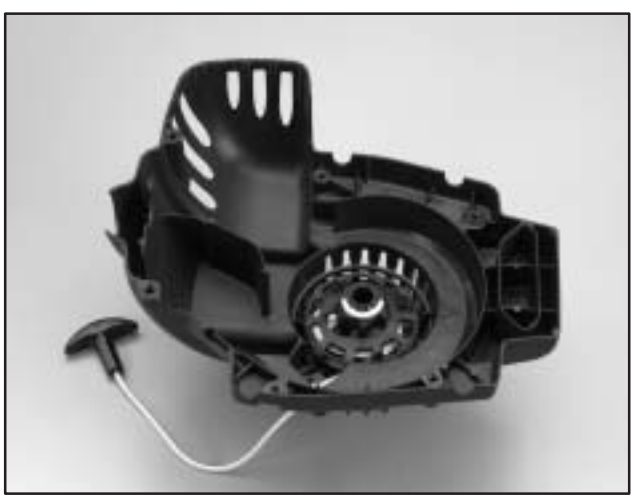
The valves are both stainless steel and use a 45 degree angled valve face. Valve clearances are established by setting the piston ¼" past top dead center on the power stroke.



Trimmer engines are typically multi positional which can be a challenge for a 4 cycle engine. There is no mixing of oil and gas which allows the engine to burn cleaner and more efficiently, unlike 2-cycle engines. The Fource™ engine uses an innovative lubrication approach called the Pulse Splash Lube System™. The cylinder block employs an internal baffle arrangement that has strategically located oiling ports. The oiling ports allow the engine to be rotated 360 degrees intermittent, or 270 degrees of continuous use and still retain positive lubrication.

The rewind is an integral part of the blower housing and held in place by the use of a clinch ring retainer. If servicing is required all parts are replaceable.



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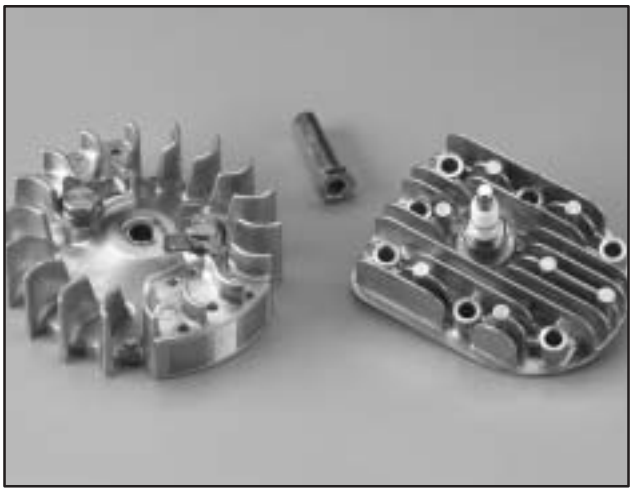
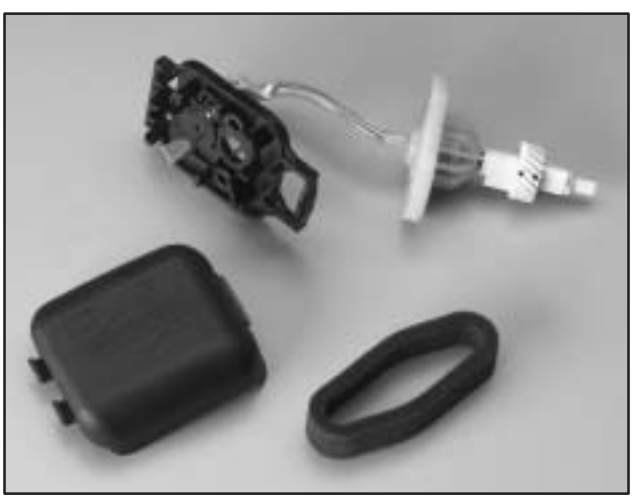
Both the cylinder head and flywheel are cast aluminum and are produced exclusively for Briggs & Stratton. The flywheel incorporates a cast in key for timing.



The carburetor is a Walbro style with a fuel pump combined system. The green hose is color coded to provide easy identification as the fuel supply and the clear hose is for the fuel return back to the tank.

The cam gear is a part of the centrifugal style breather, and is located perpendicular to the crankshaft. The cam gear is hollow, functioning as a pathway to the breather and is driven off the crankshaft by a worm gear. The air cleaner is an oiled foam filter, that encompasses a simple one way duck bill that sits in the air filter housing. The breather must be in place in order to properly adjust the valve clearance.



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GOVERNORS: THEORY, ADJUSTMENT AND TROUBLESHOOTING

Engine governor systems have been around almost as long as engines. Before governors were added as a separate system, speed was controlled by the work the engine was required to do. These primitive systems used carburetors without throttle plates or with throttle plates held in a fixed position. Handling the load applied to the engine and preventing the engine from damaging itself from operating at high speed became precarious at best.

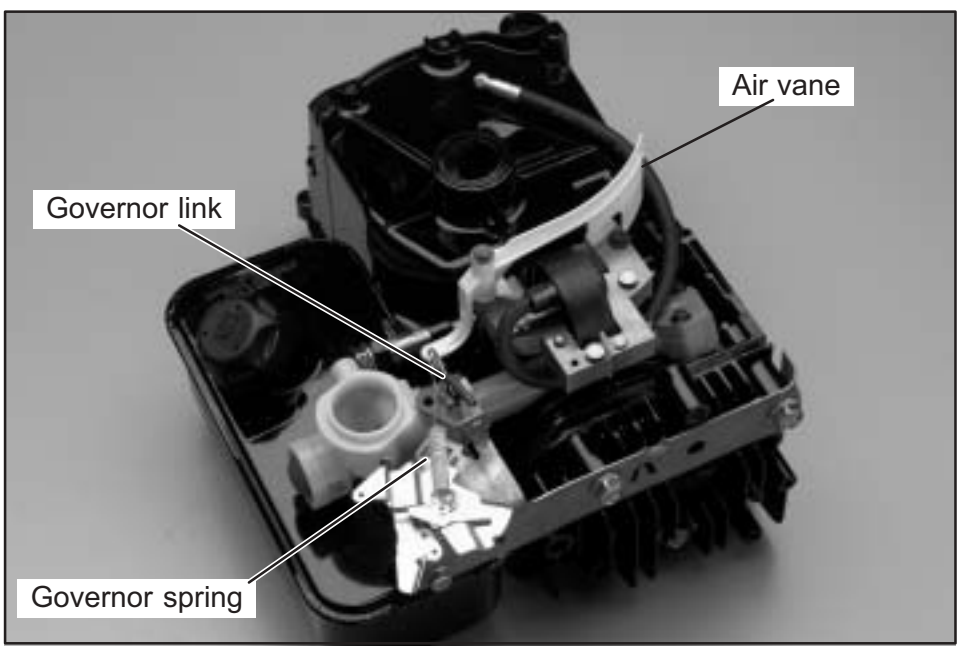
The chief function of an engine governor is to maintain engine speed under varying loads and conditions. Engine speed is ultimately dependant on load and throttle plate position. As load is the work that the engine has to do, it stands that the very nature of the governor system is to control throttle plate position in response to load. In operation, a governor performs much as an automobile cruise control does. The cruise control is engaged to hold an automobile at a set ground speed.

Assume that a car is traveling at a steady 50 mph on a flat, straight highway. Under this condition, the throttle plate position is all but closed. The cruise control delivers just enough fuel and air to keep the car rolling at the specified 50 mph. Now, the car comes upon a hill. Ground speed starts to drop off as there is not enough power to drive the weight of the car up the incline. The cruise control responds by opening the throttle plate and more fuel and air is allowed into the engine. The car crests the hill and starts down the other side. Since gravity is now doing most of the work, ground speed begins to increase and the cruise control module closes the throttle plate. The car's speed has been successfully controlled under varying loads and conditions.

Briggs & Stratton uses three different types of governing systems, the pneumatic or air vane, mechanical and electronic. Strikingly different from each other, their common thread is that they all operate by balancing forces.

AIR VANE GOVERNOR

The air vane governor system was the predominate engine control system used until recently when it was surpassed by the mechanical system. It is a simple, uncomplicated system consisting of the components shown to the right and supported by the blower housing and flywheel fan (not shown).



The air vane is free to move around a pivot point anchored to the engine. The link extends from the vane directly to the throttle shaft where it is joined by one end of the spring. For fixed speed applications, the other end of the spring need only go to a stationary anchor.

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Variable speeds require some method to increase and decrease spring tension incrementally and the aptly named speed control bracket is typically used.

Operation is fairly straightforward. As the flywheel turns, the vanes capture air and move it in the direction of flywheel rotation. The blower housing provides an entrance, a pathway for the air to follow and an exit, directing the airflow along the cooling fins to the outside.

The amount of air moved is dependent primarily on engine speed. The relationship between engine speed and air movement suggests that by monitoring air speed, we should be able to monitor engine speed as well. The air vane governor system does just so by installing an air vane or paddle directly in the path of air flow. This works because air has mass and mass plus velocity equals force. Air mass will stay relatively the same. What the governor system responds to is variations in force against the air vane sensing device.

This air vane is tied directly to the carburetor throttle plate by the governor link, in such a way that as air speed/force increases, the vane tries harder and harder to close the throttle plate. This is one half of the governor equation. The other half is the governor spring, which is also tied to the throttle plate via the linkage. The difference is that the governor spring's job is to hold the throttle plate in the open position. Since throttle plate position controls engine speed, the governed speed of the engine, then, is the throttle plate position established when air pressure from the flywheel fins balances against spring pressure from the governor spring.

On a variable speed application, moving the throttle control to the slow position reduces governor spring tension, air pressure has a greater advantage, and the engine slows down. Moving to the fast position increases spring tension giving the governor spring the advantage, and speed increases until the forces balance again.

CHANGES IN LOAD

The throttle plate position of a lawn mower engine running steadily at top-no-load speed is almost closed. Only a small amount of fuel and air is needed to generate the torque necessary to overcome the internal friction of the engine and keep the mass of the blade moving. As load is applied, more torque is required. Since excess torque is converted into speed, engine speed drops because the torque is needed elsewhere to do work. Reducing engine speed changes blower housing air speed and the governor spring gains the advantage, opening the throttle plate.

ADJUSTMENT PROCEDURES

Speed ranges for air vane governor systems are established by changing governor springs. Each spring will normally have a range of 200 to 300 rpm. Bending a spring tang to increase or decrease spring tension is the typical fine tuning adjustment. Some engines may employ an adjustment screw to accomplish the same thing.

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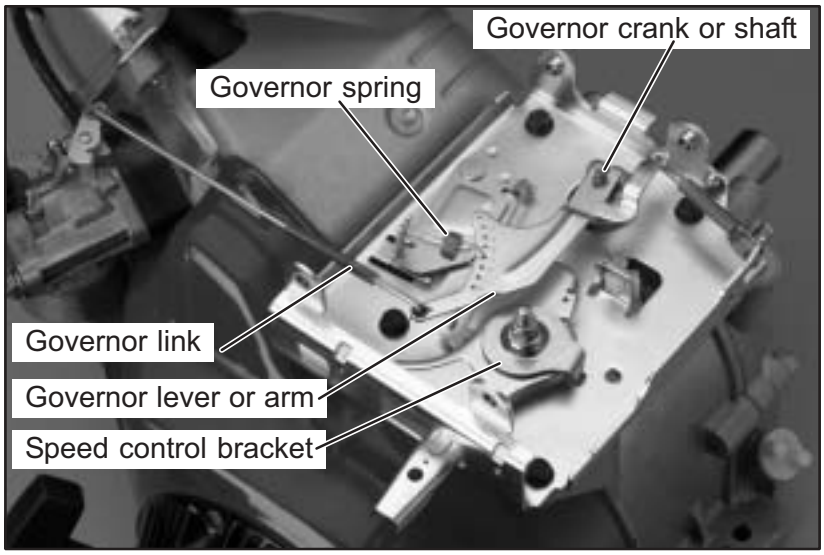
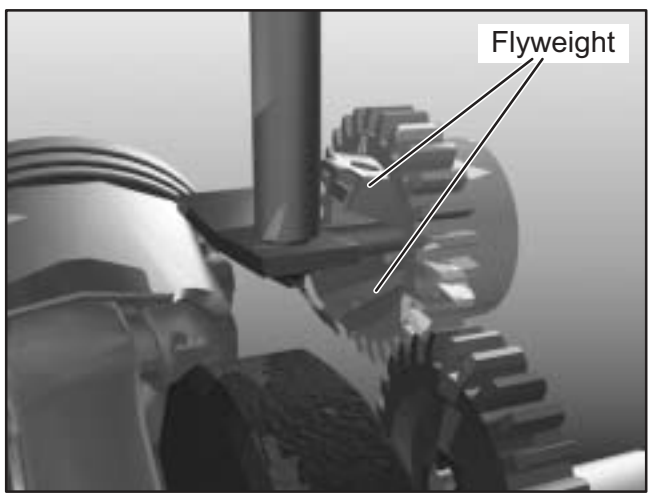
MECHANICAL GOVERNOR



The mechanical governor system functions on the same principles as the air vane system. A governor spring is still used as one half of the "balance" equation, acting directly on the throttle plate. An engine driven governor gear assembly (not shown) creates the second force.

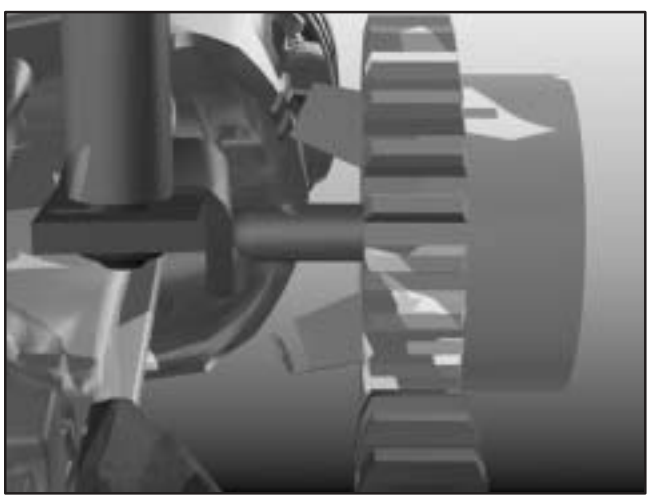
As the name implies, the governor gear assembly is tied directly to the crankshaft via a drive gear. The sensing device typically consists of two flyweights although up to four are found on some Briggs & Stratton engines. As the gear spins, centrifugal force acts on the weight and causes it to fly out. The final component is the governor cup, which is tied directly to the flyweights and changes a rotational force into a linear motion.



This motion is transmitted via governor arms, links and/or bell cranks to some point where it can meet the force of the governor spring.

OPERATION

On engine start up, the throttle control is moved to the wide open position giving the governor spring the advantage and holding the throttle plate wide open. As the engine develops speed, the flyweights react and move out from their pivot point, transmitting force back to the throttle plate to act against the spring tension. The engine finds its governed speed when the two forces balance.



Flyweights out

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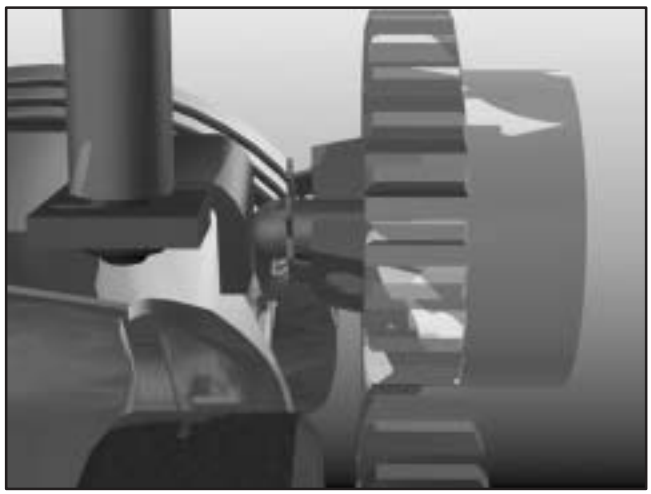
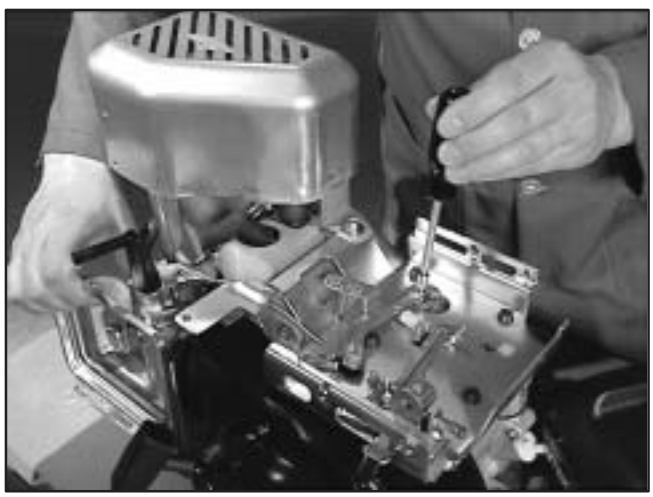
CHANGES IN LOAD

When a load is applied, engine speed is reduced and the flyweights move in, reducing the force. The governor spring gains the advantage and pulls the throttle plate open. Engine speed increases and the flyweights move out, balancing the forces again.



Flyweights in



ADJUSTMENT PROCEDURES

Static

A static governor adjustment should be performed if the carburetor, crankcase cover or oil sump are removed and reinstalled, or if any governor components have been replaced or disturbed. On nearly all Briggs & Stratton mechanically governed engines, the adjustment point will be a slip joint between the governor shaft and the governor arm.

The governor lever is secured to the governor shaft by a pinch bolt. The adjustment procedure is to loosen the pinch bolt, rotate the governor arm in the proper direction and tighten and torque the pinch bolt. The adjustment is made with the speed control in the fast or wide open throttle position. Because the governor gear assembly's job is to close the throttle plate, making the adjustment in the fast position assures the linkage will provide full range of travel to the idle stop.

Some engines require specific alignment procedures so it pays to consult the manual to gather information on an unfamiliar model.

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Throttle plate closed

Throttle plate open

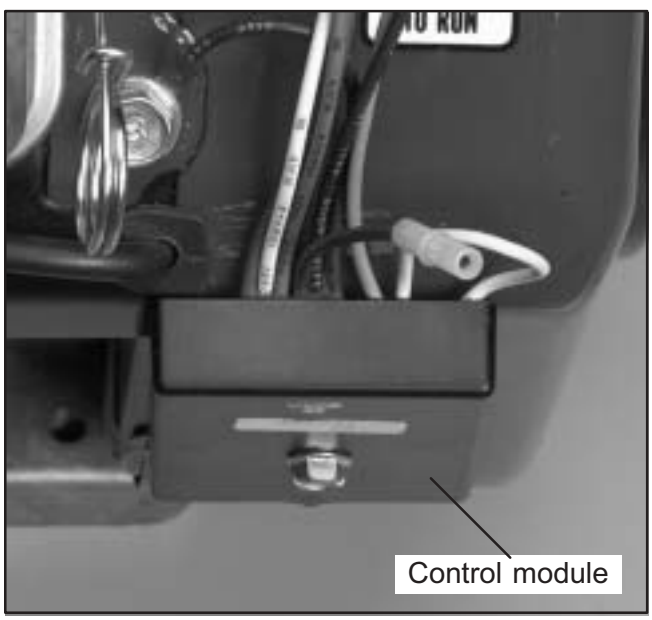
SERVICE TIP

To establish which direction to turn the governor shaft, refer to the appropriate repair manual or perform the following procedure.

Manually turn the throttle shaft so that the throttle plate is in the closed position or that the throttle shaft is against the idle stop screw if so equipped. The next step is to rotate the throttle shaft to the wide open position. While performing this operation, watch what direction the governor shaft turns. Whichever direction this is, clockwise or counterclockwise, is the direction to turn the shaft in when making the static adjustment.

Dynamic

Top no load speed ranges are established by installing different governor springs, or by moving a single spring to a different location. Fine tuning is accomplished by increasing or decreasing spring tension. This is done by bending the stationary spring anchor in or out or by a mechanical adjustment such as an adjustment screw or rod that does the same thing.



ELECTRONIC GOVERNOR

A microprocessor monitors the ignition system, basically counting ignition pulses. At 3600 revolutions per minute, there should be 3600 pulses in 60 seconds. Fewer or greater cause a signal to be sent to a limited angle torque (LAT) motor coupled directly to the throttle shaft via linkage. A LAT motor can be precisely positioned by voltage signals, which travel at near the speed of light. System monitoring and response are nearly instantaneous.

The ultimate effect of this system is an engine with virtually no governor droop.

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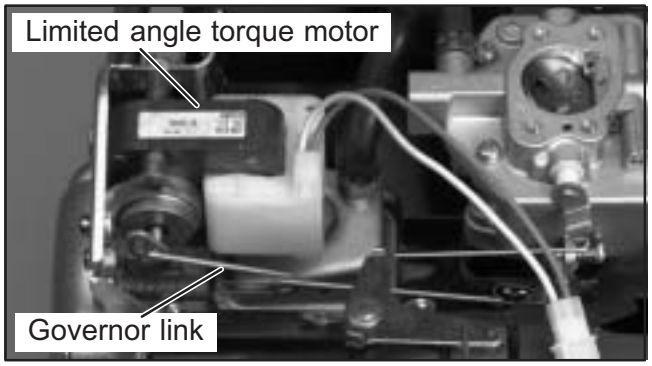
The use of an electronic governor is fairly limited on Briggs & Stratton engines, being fitted on several V-Twin Vanguard engines and on a few three cylinder liquid cooled gas powered engines.

The electronic governor system offers some distinct advantages but does have some limits. At this time, only two top no load speed settings are available and aimed at the generator market. The choice is for 50 or 60 hertz which sets rpm at 3000 or 3600 respectively. 60 hertz is the default setting domestically.



ADJUSTMENTS

There are basically no adjustments to these systems.

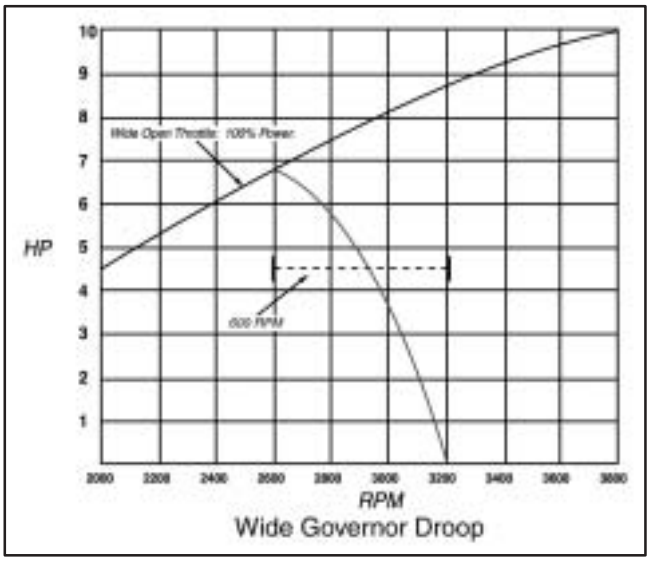
GOVERNOR DROOP

The governor is designed to maintain the engine's speed under varying load conditions. As load decreases engine speed, the governor causes more power to be developed. Governor droop is the variation in rpm between top no load speed and the point at which maximum power (not torque) is delivered.

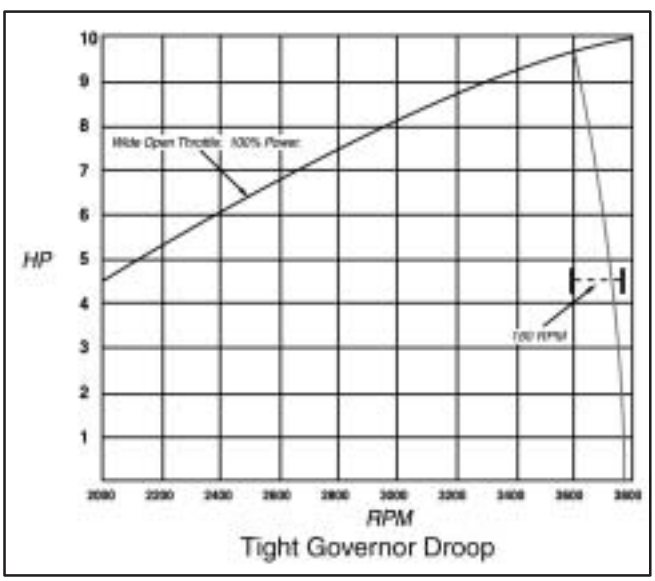
Governor droop is one way to describe governor sensitivity, as a direct relationship exists between the two. Lawn mower applications with air vane governors typically have a wide governor droop – in the neighborhood of 700 to 900 rpm. The application does not require a terribly sensitive governor but rather stable engine operation. Generator applications require a tighter governor droop and consequently a more sensitive governor system to carefully control engine speed.

Speed correlates directly to electrical frequency. Unless the unit maintains close to 60 cycles per second, damage may occur to equipment operated from the generator. Governor droop for generators is typically held at 180 rpm. You may have noticed that generators are more prone to hunt and surge slightly at top no load speed than other applications. This is a result of increasing sensitivity to reduce governor droop.

GOVERNOR DROOP COMPARISON



Wide Droop
Stable
Results in less available power
Simple design
Easy to alter original speed



Tight Droop
Less stability
Results in more available power
More complex
Requires careful speed setting

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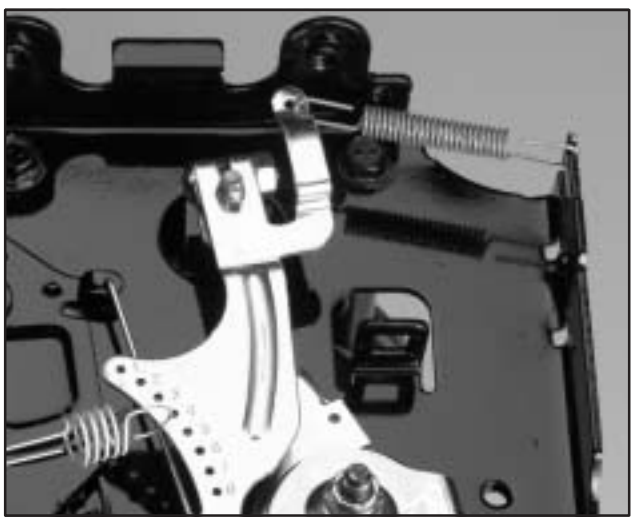
GOVERNED IDLE

Briggs & Stratton air cooled engines are arguably at their best when run at top no load speeds. The cooling, lubrication and governor systems are all at their peak. Few would consider pushing a lawn mower into the grass with the engine at idle speeds. There are, however, some applications where loads applied at idle or slower throttle speeds are convenient for consumers. Jockeying a lawn tractor around in the garage may be one.

Most governor springs are not under tension when the throttle control is in the idle position. As soon as a load is applied that is greater than the engine torque created at idle, the engine will stall. Governed idle is a feature that allows an engine to accept light to medium loads at slower or idle throttle positions.

Engines with governed idle typically add an additional governor spring. In fact, it is this spring that actually holds the throttle shaft in the idle position. Mechanical idle stops will always be set to a lower speed than the engine idle speed. An engine with governed idle is always “on the governor” and will be more responsive to load. Note that this spring is under increasing tension from idle to top no load speed. When making top no load speed adjustments on engines with separate springs for idle control, the governed idle speed must be adjusted before top no load as any change in the idle spring tension will also affect top no load speed settings.



A typical adjustment scenario follows.

Start engine and bring to normal operating temperature. Adjust carburetor idle stop screw so engine idles at 1600 rpm. Bend governed idle spring tang until idle speed is 1750 rpm. Move throttle control to wide open throttle position. Bend main governor spring tang until top no load speed is 3600 rpm.

Some engines feature governed idle but have a single governor spring. The adjustment procedure is similar except that instead of increasing or decreasing tension on a separate spring for idle control, they provide a mechanism such as a tang to bend or a screw to adjust that limits the travel of the speed control bracket towards the idle position. Idle speed for these is established by the main governor spring.

Most modern day engines have provisions for governed idle although not all applications require it. Engines with governed idle generally have a tighter governor droop which provides more useable power, and operate more efficiently. Efficient engines often present fewer emissions.

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PERFORMANCE OR OPERATIONAL PROBLEMS ASSOCIATED WITH THE GOVERNOR SYSTEM:

- **Engine overspeeds or runs too fast**
- **Engine can't obtain proper speed or runs too slow**
- **Hunting and/or surging**
- **Inability to handle load**

Runs too fast – overspeeding

Air Vane:

- Plugged or restricted air intake at blower housing
- Plugged cooling fins
- Mouse nest or debris blocking air vane
- Broken/binding air vane
- Wrong spring or damaged, shortened, twisted, incorrectly installed spring
- Top no load speed improperly adjusted
- Worn, bent or binding linkage or other components
- Bent or damaged speed control bracket

Mechanical:

- Static adjustment – out of adjustment or incorrect adjustment
- Wrong spring or damaged, shortened, twisted, incorrectly installed spring
- Top no load speed improperly adjusted
- Worn, bent or binding linkage or other components
- Bent or damaged speed control bracket
- Damaged governor gear assembly

Electronic:

- Control module defective
- Return spring missing/broken

Mechanical governor systems have internal and external components. Assuming that an overspeed problem is the fault of internal engine components can waste a lot of time if this is not the case. To examine the governor gear assembly for faults can require that the engine be removed from the equipment and disassembled.

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SERVICE TIP

Follow this procedure to determine if an overspeed governor problem is internal or external:

Perform a static governor adjustment. Remove or unhook governor spring(s). Start engine. Quickly move throttle shaft towards the wide open throttle position. If the internal governor gear assembly is functioning, the throttle shaft should immediately return to idle. Problem will be external.

Runs too slow

Air Vane:

- Mouse nest or debris blocking air vane
- Air guides or baffles missing allowing air to escape
- Wrong spring
- Spring stretched
- Incorrectly installed spring
- Bent or damaged speed control bracket
- Improperly adjusted throttle control cable

Mechanical:

- Linkage binding
- Wrong spring
- Spring stretched
- Incorrectly installed spring
- Bent or damaged speed control bracket
- Improperly adjusted throttle control cable

Electronic:

- Defective control module
- Wiring to LAT motor broken/disconnected
- Defective LAT motor

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Hunting and surging

These are undesirable operational traits that may be attributable to the governor system. Hunting is a quick changing of rpm when set at a given speed. Surging is a slow, cyclical change of rpm, also when set at a given speed. Since both have similar causes, they are generally considered together.

SERVICE TIP

Since an overly lean fuel mixture can also cause hunting and surging, it is necessary to isolate the fuel system from the governor system when troubleshooting this condition.

Start the engine and bring to normal operating temperature. Position the throttle control at roughly half throttle. Screw in the idle stop screw until engine speed is in the 2800 to 3400 rpm range. Manually hold the throttle shaft against the idle stop screw. If hunting and surging goes away, the problem is in the governor system. If it continues or engine stalls, the problem is in the fuel system. Repair fuel system and recheck.

Note: Some carburetors do not have idle stop screws and some carburetors with idle stop screws do not have enough screw travel to allow the speed to be raised to 2800 rpm. Some other method will need to be devised to hold the throttle shaft steady.

Air Vane:

- Carburetor adjustment, air leaks
- Worn, bent or binding linkage or other components
- Bent or damaged speed control bracket
- Spring in resonance
- Wrong spring installed

Mechanical:

- Carburetor adjustment, air leaks
- Worn, bent or binding linkage or other components
- Bent or damaged speed control bracket
- Spring in resonance
- Wrong spring installed

Electronic:

- Lip seal or bearing binding at throttle shaft

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Inability to handle load

This may be a tricky area to investigate, as a variety of areas may have to be explored. Although it is usually OK to assume that an OEM piece of equipment with the original engine should be capable of performing its job, this is not always the case. For the purpose of this discussion, we will assume that the engine and equipment are properly matched.

SERVICE TIP

Application engineers use this approach as a rule of thumb to help establish a good marriage between engine and equipment.

Make sure engine is broken in, at operating temperature and properly adjusted. Apply maximum load equipment is designed to handle. Take an rpm reading with an accurate tachometer. Manually force the throttle shaft to wide open throttle. Take an rpm reading. If the reading is at least 200 rpm more than that taken at maximum load, the engine offers enough power.

Air Vane and Mechanical:

- Engine in poor mechanical condition
- Engine underpowered for load
- Governor spring broken
- Wrong governor spring installed
- Worn, bent or binding linkage or other components
- Bent or damaged speed control bracket

Electronic:

- Engine in poor mechanical condition
- Engine underpowered for load

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SPECIAL CIRCUMSTANCES

Dual governor springs on walk-behind mower engines.

Several years ago, a second governor spring was added to some 9 and 10 cubic inch displacement vertical shaft engines. This may appear to be a governed idle spring and may even be listed as such in some illustrated parts lists. It is a secondary governor spring, not a governed idle spring and requires a specific adjustment procedure.

1. Run engine until it reaches normal operating temperature.
2. Move speed control lever to the fast position, aligning holes in bracket and lever. Insert 1/8 inch rod through holes, locking bracket and lever positions.
3. Bend secondary governor spring tang until there is no tension on the spring.
4. Bend primary governor spring tang until rpm is 200 less than the listed top no load rpm.
5. Bend secondary spring tang until top no load rpm is obtained.

Industrial Plus – single governor spring with governed idle adjustment

This is a rather simple approach to holding the engine at idle speeds by the governor spring.

1. Run engine until it reaches normal operating temperature.
2. Move speed control bracket down until engine is at minimum rpm. Adjust idle speed at carburetor idle stop screw to 1600 rpm.
3. Move speed control lever to obtain 1800 rpm.
4. Bend governed idle speed control tang up against speed control lever to prevent control from going lower.

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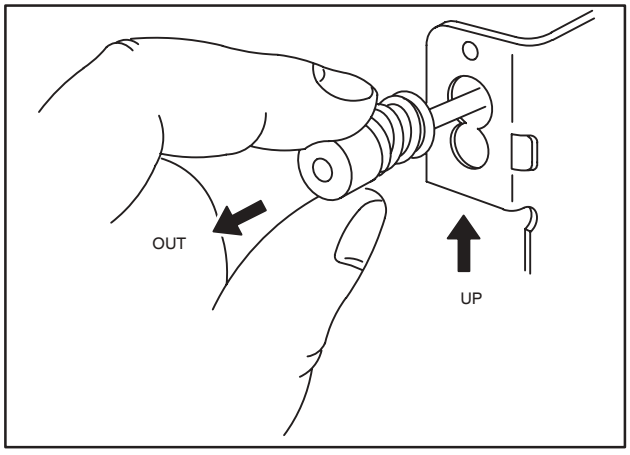
Generator engines – fooling governor system by overspeeding

Most engines for generator application are set at speeds higher than the rpm required for the proper frequency to allow for governor droop rpm loss. Normal, loaded operating speed for 50 hertz generator sets is 3000 rpm and 60 hertz is 3600. It is important to hold the correct frequency or damage may occur to appliances operated by the equipment. These applications generally run a tighter governor droop, somewhere in the neighborhood of 150 to180 rpm. In anticipation of the droop figure, top no load speed is normally adjusted upwards. Therefore, top no load speed for many generators is specified at 3150 to 3180 for 50 hertz or 3750 or 3780 rpm for 60 hertz.

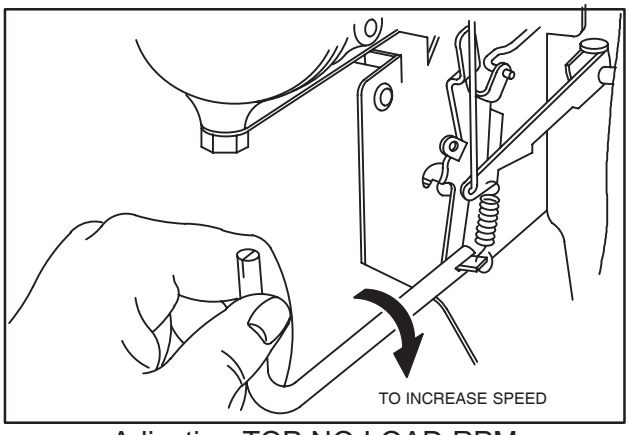
Some governor packages require somewhat more complicated adjustment procedures to make sure the proper frequency will be maintained under load. These are typically systems that use a rack and pinion or swivel type control bracket. The nature of these systems is that as speed is increased or decreased via the speed control bracket, the spring angle changes – sometimes considerably. The effect of a change in the spring angle is the same as if the spring rate was changed. A more acute angle correlates to a decrease in spring rate. A decrease in spring rate typically results in a tighter governor droop, which can lead to system instability. A fairly common approach for swivel or rack and pinion speed control bracket adjustments when used for generator applications follows.

1. Run engine until normal operating temperature is achieved.
2. Disengage speed control nut and set speed control bracket at wide open throttle position.
3. Refer to repair manual for correct governor pre-set rpm – typically several hundred rpm above top no load.
4. Bend governor spring tang to achieve rpm.
5. Engage speed control nut.
6. Turn nut to adjust speed to 3150 rpm for 50 hertz generator sets or 3750 rpm for 60 hertz generator sets.

This procedure is frequently referred to as “fooling the governor system” but is actually making the best of a utility engine application with a wider droop curve and allowing it to be used to power generators which require a much tighter droop.



Speed Adjusting Nut



Adjusting TOP NO LOAD RPM

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ADVANCE PRODUCT SERVICE INFORMATION

INFORMATION BULLETIN #15 **DATE** May 20, 1996

SUBJECT **New Governor Control Bracket**
Model Series 9B900, 9C900, 98900, 10A900, 10B900, 10C900

FILE IN Section 5
MS-4750

As of May 20, 1996, the above mentioned Model Series will have a revised governor control bracket with two (2) governor springs. This bracket can be used three (3) ways, as a manual friction control, remote control, or fixed adjustable control, Fig's. 1, 2, and 3.

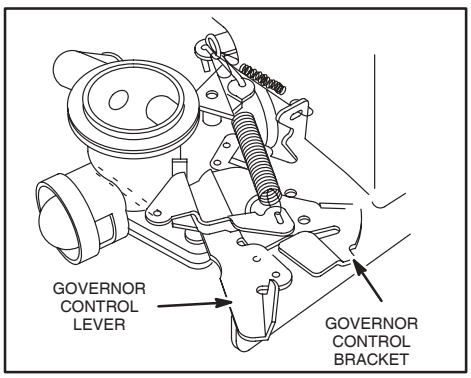

Fig. 1 – Manual Friction

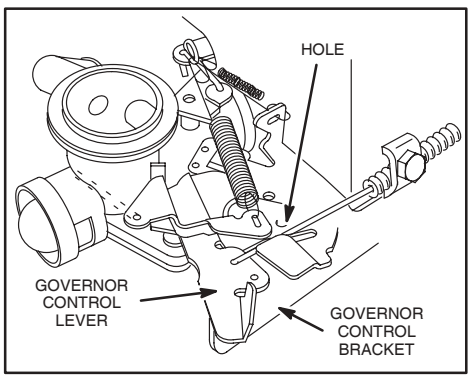

Fig. 2 – Remote Control

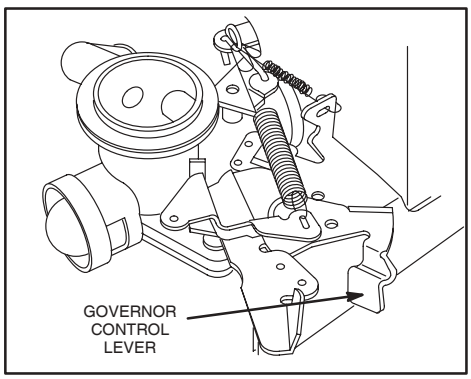

Fig. 3 – Fixed Adjustable

This bracket requires a different procedure for adjusting "TOP NO LOAD RPM," Steps 1 through 5.

1. Start engine and run until it reaches operating temperature or for about 5 minutes.
2. Move governor lever to "Fast Position." Hole in lever will line up with hole in governor control bracket, Fig. 4.
3. Using Tool #19229 or 19352, Tang Bender, bend secondary governor spring tang until there is no tension on secondary spring, Fig. 5.
4. Bend primary governor spring tang until engine speed is 200 RPM less than "TOP NO LOAD" RPM, Fig. 6.
5. Bend secondary governor spring tang until "TOP NO LOAD" RPM is obtained, Fig. 5.

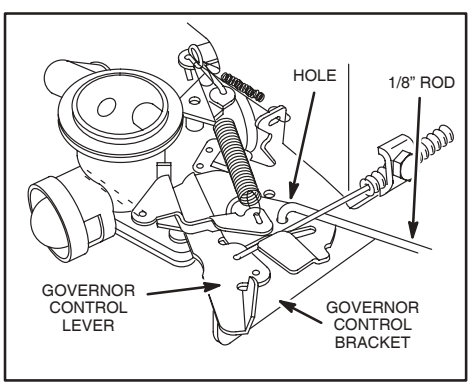

Fig. 4 – Locating Hole

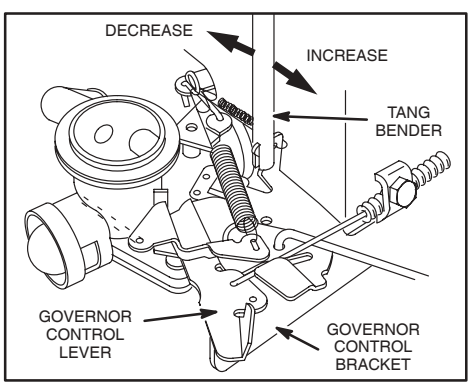

Fig. 5 – Secondary Spring Adjustment

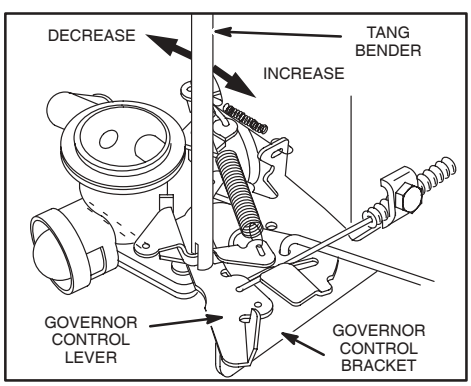

Fig. 6 – Primary Spring Adjustment

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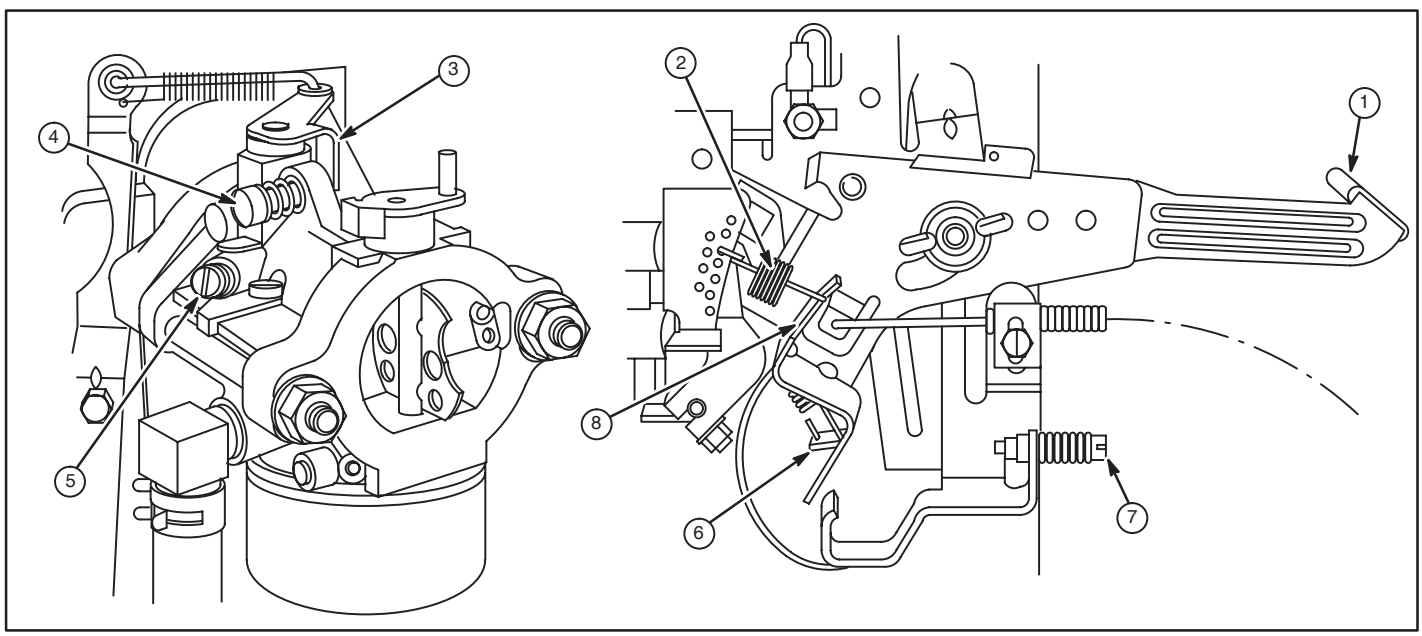
ADVANCE PRODUCT SERVICE INFORMATION

INFORMATION BULLETIN #22
SUBJECT: Revised Governor Controls
MODEL SERIES: Horizontal Shaft 170000, 190000, 220000, 250000

DATE	**May 97**
FILE IN:	**MS-4750**
Sec. No.	**5**
Dated	**Nov 94**

The governor control system on Model Series 176400, 19A400, 19B400, 19C400, 19E400, 19F400, 19G400, 192400, 196400, 197400, 226400, 250400, 256400 is being changed from a single governor spring system to a two spring system. The new system will require new adjustment procedures, when both springs are used. Engines with generator controls will only have a governor spring change, but adjustment will remain the same as shown in MS-9939, Sec. 5 dated November/94.

6. Start engine and allow to warm up for five (5) minutes.
7. Move speed control lever ① down until there is slack on main governor spring ②.
8. Hold throttle lever ③ against idle speed screw ④, and turn idle speed screw ④ until engine idles at 1750 RPM.
9. While still holding throttle lever, adjust idle mixture needle ⑤ to midpoint between too lean and too rich.
10. Repeat Step 8. turning idle speed screw ④ to reduce engine idle speed to 1200 RPM.
11. Bend governed idle speed tang ⑥ to obtain 1750 RPM.
12. Move speed control ① to fast position. If control lever stop is against high speed adjustment screw ⑦, back out high speed adjustment screw until stop no longer touches screw.
13. Adjust main governor spring tang ⑧ until you have 100 to 150 RPM over the final TOP NO LOAD RPM required.
14. Adjust high speed adjustment screw ⑦ to obtain correct TOP NO LOAD RPM.



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SERVICE BULLETIN

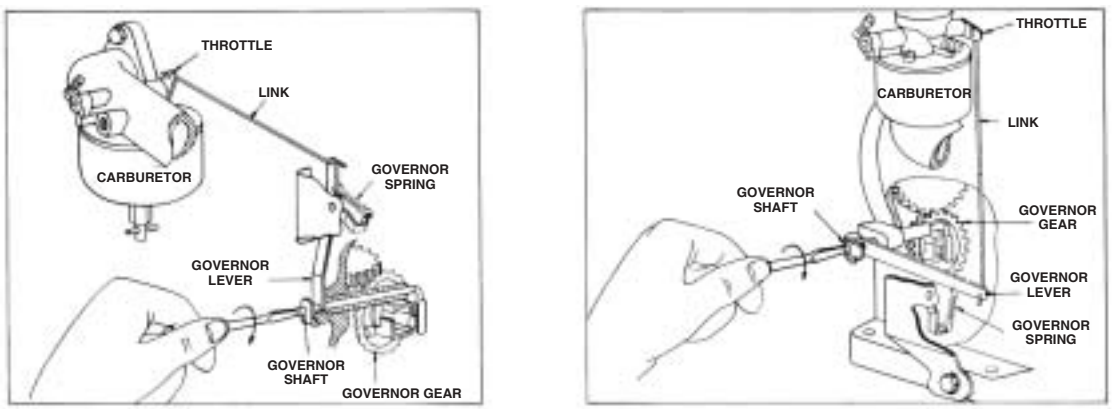
TO ALL AUTHORIZED SERVICE ACCOUNTS

No. 519
Replaces No. 486
DATE 9/00
FILE IN Bulletin Binder

SUBJECT **Governor Hunting or Engine Surging on 7hp and 8 hp engines**

We have received reports regarding governor hunting on 7 and 8 H.P. engines in Model Series 170400, 170700, 190400, 19540, 190700 and 191700. Usually, governing hunting occurs because of one, or a combination of the following. Check these conditions in the order listed.

1. IMPROPER CARBURETOR ADJUSTMENT: When an engine is operating under no load, or light load, the throttle is in a nearly closed position. Under these conditions, the engine receives fuel though the idle circuit of the carburetor. If the idle mixture is either too lean, or too rich, to sustain operation, speed decreases and the governor then opens the throttle, permitting the engine to receive fuel from the high speed circuit (holes in main nozzle) of the carburetor. Speed then increases and the governor returns the throttle to a nearly closed position. This cycle is repeated, again and again, resulting in governor hunting. In many cases, therefore, governor hunting can be eliminated by simply adjusting both the needle valve and the idle valve for proper carburetor mixture.



VERTICAL CRANKSHAFT MODELS — HORIZONTAL CRANKSHAFT MODELS

FIG. 1 – ADJUST GOVERNOR

2. IMPROPER GOVERNOR ADJUSTMENT: Governor hunting may occur if the governor lever does not have the proper angular location on the governor crank. Governor adjustment must be made only when the engine is stopped.

   To check the adjustment, move the control to the high speed position. The throttle must be in the wide open position. Loosen the nut on the governor lever. Turn the governor shaft clockwise to end of the travel, as shown in Fig. 1. With the governor shaft in this position, and with the throttle in the wide open position, tighten the nut on the governor lever.

   Check to be sure the throttle can be moved from idle to wide open without any binding.

3. GOVERNOR SENSITIVITY: Hunting may also occur if the governor is too responsive for the particular piece of equipment on which the engine is used. The force exerted by a governor spring is measured in ounces per inch, and is called the spring rate. The greater the rate, the stiffer the spring. To make the governor less responsive, a stiffer governor spring may be installed. First, use a tachometer to record the top governed speed of the engine, at no load. Next, use the appropriate Illustrated Parts List to determine the number of the original governor spring. Then, use the chart which follows to select the stiffer governor spring.

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ORIGINAL GOVERNOR SPRING	USE GOVERNOR SPRING
261130 261126	260695
260695	261129
260871	260723*
261129	260723*
260723	260931

* On horizontal shaft models, which have a top governed speed between 3000 and 4000 R.P.M., no load, use governor spring No. 261194.

After the stiffer governor spring has been installed, the top governed speed of the engine will be too high. Therefore, before starting the engine, bend the spring anchor tang to slightly reduce spring tension. The tang may be bent with a needle-nosed pliers, or with the tool shown in Fig. 2. Start the engine and use a tachometer to check the top governed speed, at no load. Bend the spring anchor, as shown in Fig. 3, to obatin the original top governed speed, at no load.

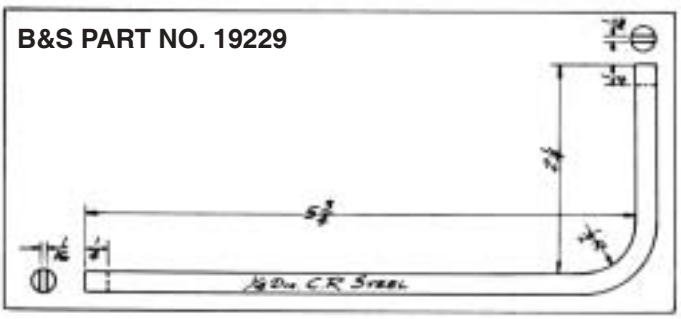
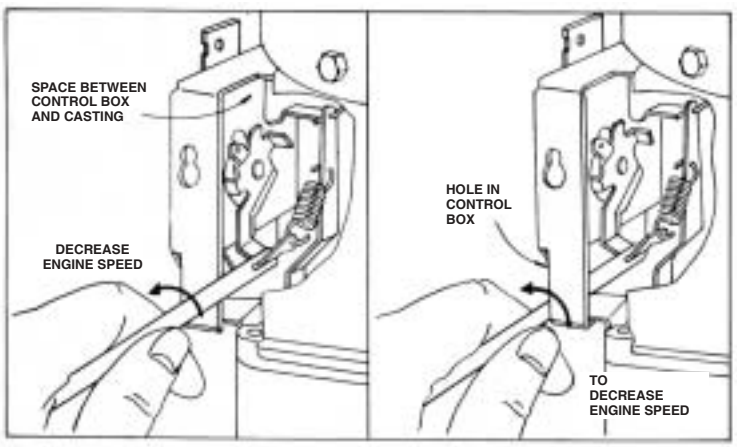
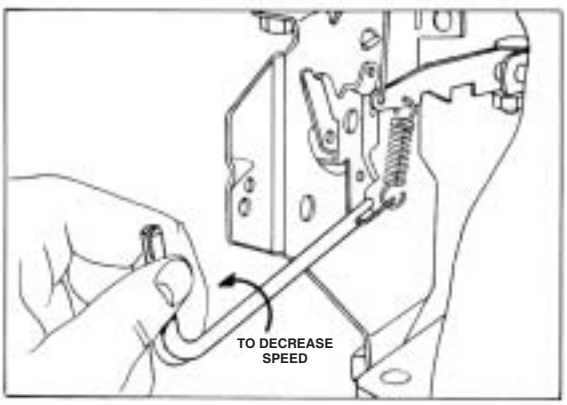


FIG. 2

If the replacement governor spring does not completely eliminate hunting, re-check items #1 and #2. If hunting persists, then install the next stiffer spring. It will be necessary to again bend the spring anchor tang to obtain the original top governed speed, at no load.



VERTICAL CRANKSHAFT MODELS



HORIZONTAL CRANKSHAFT MODELS

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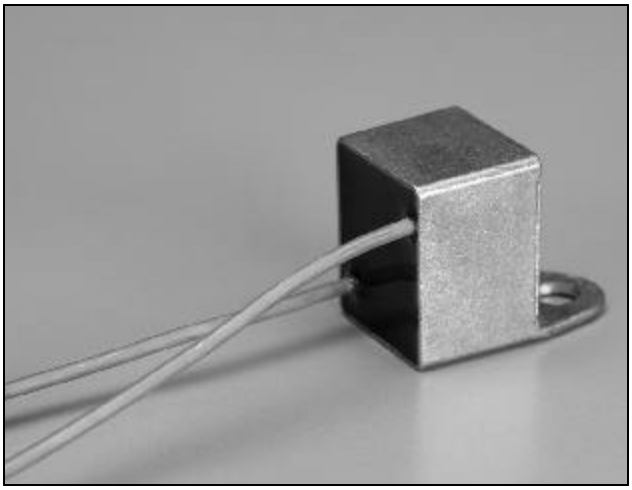
NEW ENGINE FEATURES

RUN SENSE OIL SENSOR

A few years back we introduced the Start Sense engine oil sensor on 110000 and 112000 overhead valve engines. This year we have introduced a new oil sensor called Run Sense.

The Run Sense oil sensor module not only monitors oil levels at engine start up but will also stop the engine should the oil capacity fall below acceptable levels.

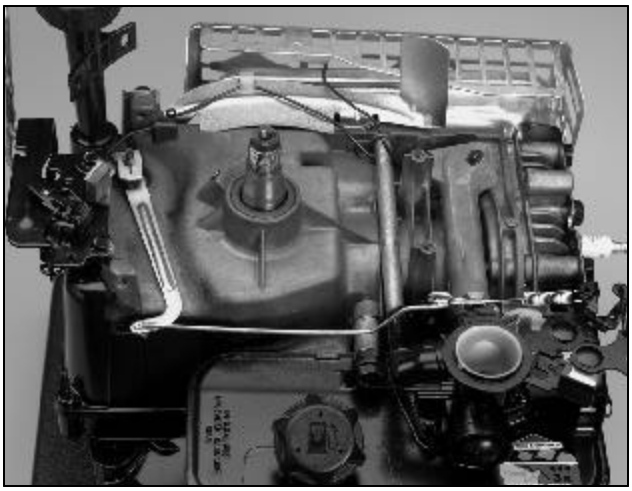


MODEL 420000 & 460000 ALUMINUM INTAKE MANIFOLD

All model 420000 & 460000 opposed twin cylinder engines manufactured after January 9, 2001 utilize a new one piece aluminum intake manifold. The new manifold offers enhanced flow and reduced emissions.

MECHANICAL GOVERNOR

Starting in October 2001 we began building 90000 and 100000 vertical crankshaft engines with mechanical governors. Since a mechanical governor has less “droop” there is more available power and greater sensitivity enabling the engine to be installed on a wider variety of applications.



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GENERAC CHROME VALVE COVER

Generac is offering a chrome valve cover on selective engine applications. To find the model, type and code of the engine, simply remove the four nuts holding the chrome valve cover on top of the Briggs & Stratton valve cover. You will find the model, type and code stamped on the Briggs & Stratton valve cover.

NOTES

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SERVICE DEPARTMENT

ARE YOUR POSTERS CURRENT?

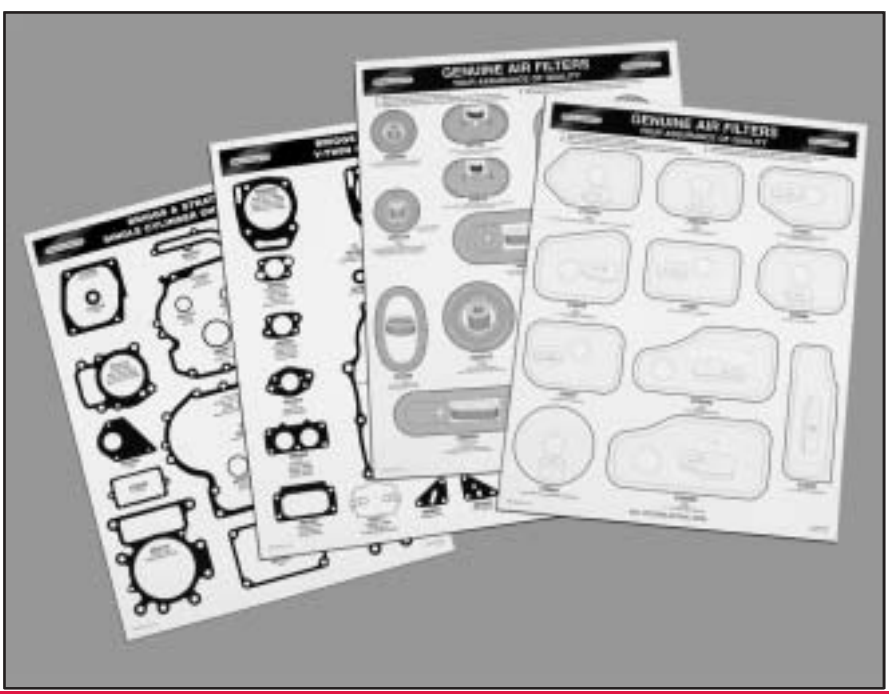
Compare the dates of your shop reference posters to those listed below. If a newer one is available then order it through your source of supply. To order all the posters listed below order part number CE9004.

UPDATED WALL CHARTS

List Of Most Recent Shop Poster Part Numbers And Print Date

- MS-0709-9/99 Single Cylinder OHV Gasket Chart (3)
- MS-0709FL-9/99* Single Cylinder OHV Gasket Chart (3)
- MS-0710-9/99 V-Twin OHV Gasket Chart (2)
- MS-0710FL-9/99* V-Twin OHV Gasket Chart (2)
- MS-2288-2/96 Alternator Chart
- MS-3957-6/99 Air Filter Chart (4)
- MS-3957FL-6/99* Air Filter Chart (4)
- MS-3992-7/98 Handy Repair Check Chart
- MS-5437-9/99 Single Cylinder “L” Head Gasket Chart (3)
- MS-5437FL-9/99* Single Cylinder “L” Head Gasket Chart (3)
- MS-5441-7/99 Twin Cylinder “L” Head Gasket Chart
- MS-5441FL-7/99* Twin Cylinder “L” Head Gasket Chart

* FL - Flat Unfolded



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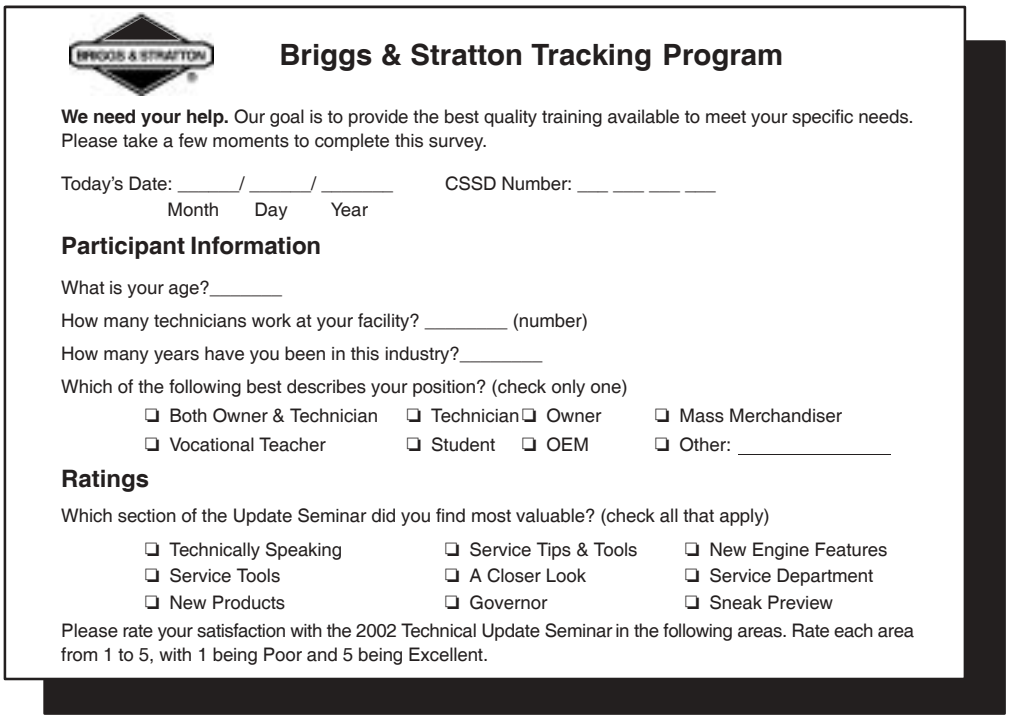

Briggs & Stratton Tracking Program

We need your help. Our goal is to provide the best quality training available to meet your specific needs. Please take a few moments to complete this survey.

Today's Date: _____/ _____/ _____ CSSD Number: ___ ___ ___ ___
Month Day Year

Participant Information

What is your age?_____

How many technicians work at your facility? _____ (number)

How many years have you been in this industry?_____

Which of the following best describes your position? (check only one)

❑ Both Owner & Technician ❑ Technician ❑ Owner ❑ Mass Merchandiser
❑ Vocational Teacher ❑ Student ❑ OEM ❑ Other: _____

Ratings

Which section of the Update Seminar did you find most valuable? (check all that apply)

❑ Technically Speaking ❑ Service Tips & Tools ❑ New Engine Features
❑ Service Tools ❑ A Closer Look ❑ Service Department
❑ New Products ❑ Governor ❑ Sneak Preview

Please rate your satisfaction with the 2002 Technical Update Seminar in the following areas. Rate each area from 1 to 5, with 1 being Poor and 5 being Excellent.

WHO ARE YOU?

Last year, we explained some of the data we have been tracking for the last few years. We received many favorable comments on the feed-back and were asked if we could expand on the information given. We are glad to deliver this information in the table below.

- **Average technicians per shop**

	1999%	2000%
0	.4	.7
1	22.7	24.5
2	34.6	37.7
3	20.8	20.3
4	8.7	8.3
5	3.8	3.5
>5	5.2	5.0
Mean Avg.		2.6

- **Average age of technicians**

	1999%	2000%
<25	9.7	9.5
25 to 34	19.0	17.7
35 to 44	29.9	29.7
45 to 54	21.5	23.7
55 & over	17.6	19.8
Mean Avg.	41.88	42.75

- **Average years in the industry**

	1999%	2000%
2 or <	12.3	12.4
3 to 5	14.0	13.9
6 to 10	17.9	18.4
11 to 20	28.4	29.6
21 to 30	17.1	18.4
>30	6.4	7.3
Mean Avg.	13.1	14.46

- **Percent of attendees that are technicians**

	1999%	2000%
Owner & Technician	34.2	35.2
Technician Only	50.4	50.4
Owner	3.8	3.8
Vo-Ed Teacher	.6	.7
Student	2.2	2.2
OEM	.2	.2

- **Percentage of dealerships with computers**

	1999%	2000%
Yes	71.3	73.2
No	26.5	24.3
DK/NA	2.4	2.5

Note: DK/NA is do not know or no answer

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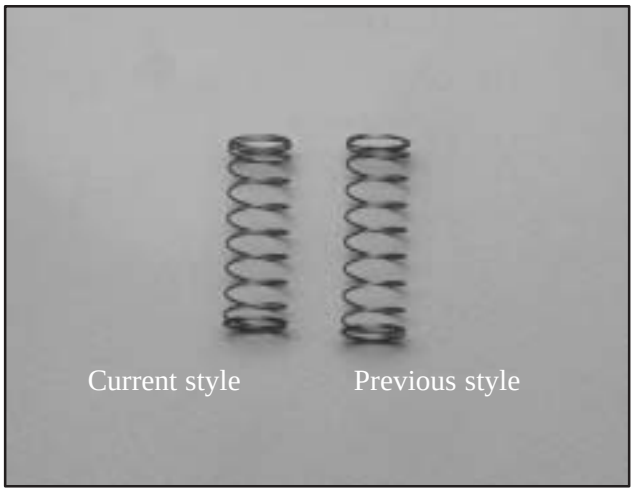
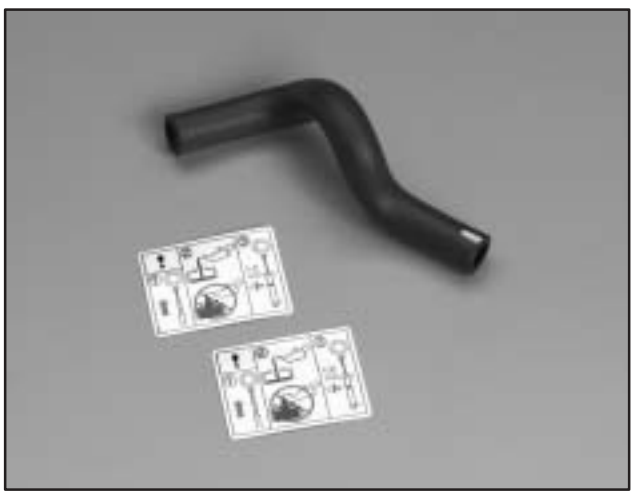
DIAPHRAGM SPRING CHANGE

A new spring has been introduced for the Pulsa Prime Carburetor on the model 90000 vertical crankshaft and Quattro™ engines. This new diaphragm spring is .100" (2.54 mm) shorter than the old spring.



CHANGE IN VANGUARD™ 3/LC DIESEL BREATHER HOSE

The breather hose for some Vanguard™ 3/LC Diesel engines has been changed in design and given a new part number. The previous part number is 820380 and the current part number is 821003. This new part number is for all Vanguard™ 3/LC Diesel Engines except the 950TD.

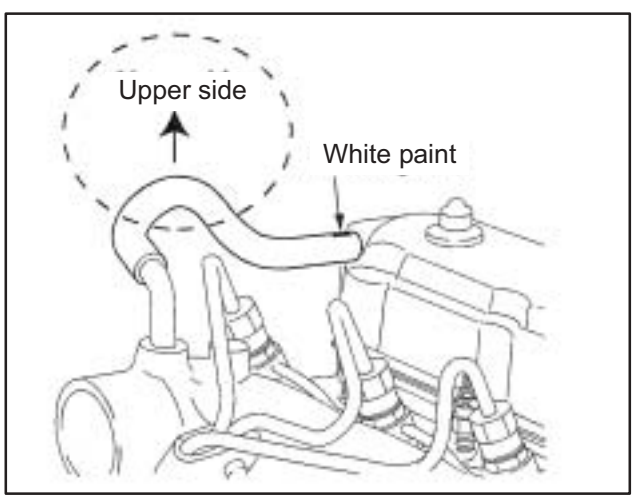


BREATHER HOSE INSTALLATION PROCEDURE

Remove original breather tube part number 820380 and discard.

Install new breather tube part number 821003 so that its protuberant section faces upper side. The hose end marked with white paint should be inserted into the valve cover side with the mark facing up.

Insert the breather hose into the intake manifold and valve cover tubes as far as it will go.



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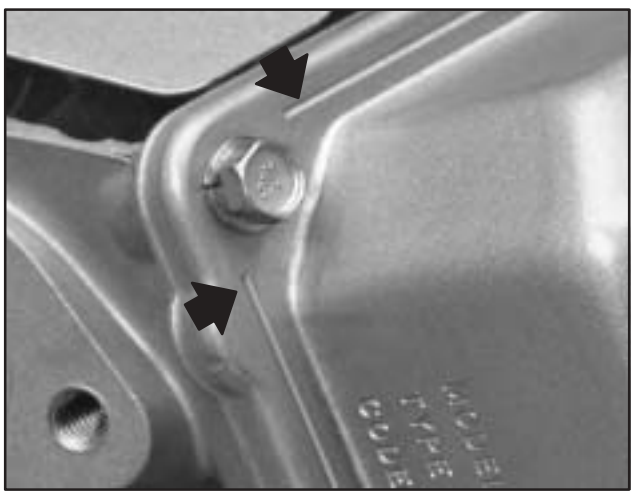
MODEL 200000 VALVE COVER MODIFICATION

The valve cover for the model 200000 engine has been modified to create a better seal on the cylinder head. A thread lock patch has also been added to the four valve cover retaining screws to prevent oil seepage along the threads.

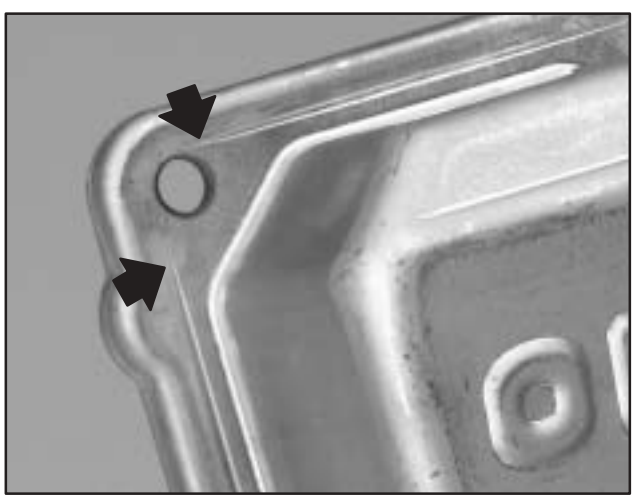
MODEL 200000 PREVIOUS PRODUCTION VALVE COVER

The previous production valve cover does not have a tapered sealing bead. If a technician notes a leaking valve cover, around the gasket surface or through the screw holes. The technician must then verify that the valve cover gasket surface is flat. The previous production valve cover should be replaced with one that has the tapered sealing bead.



MODEL 200000 CURRENT REPLACEMENT VALVE COVER INSTALLATION

The current replacement valve cover will not have a model, type and code number. There is a decal available, part number 274863, on which a technician could write in the model, type and code number from the old valve cover. Use new gaskets with new valve cover and torque the valve cover screws to 75 in. lbs. (8.47 Nm).



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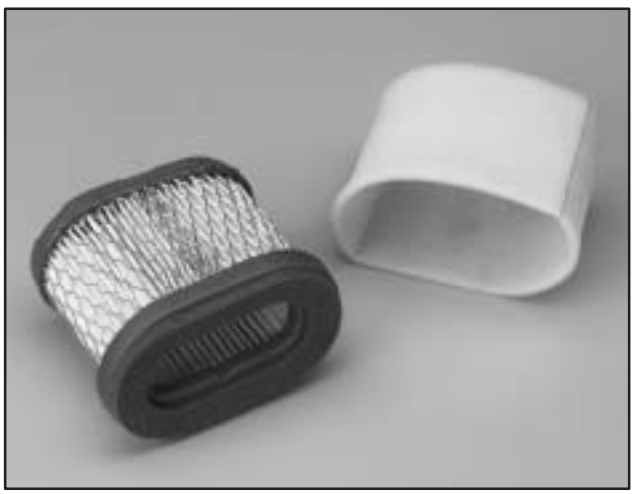
MODEL 200000 VALVE COVER REMOVAL

Remove four valve cover retaining screws. With valve cover removed run a ¼"-20 tap through all the screw holes to remove any patch that may remain.

Note: If the patch is not cleaned out from the screw holes, it will be difficult to re-install the screws. The head of the screw may not contact the valve cover even though a torque wrench indicates the proper torque has been achieved.

Drain the engine oil and tilt the head downward to allow the patch material to fall out the breather tube passage.

MODIFIED AIR FILTER ASSEMBLY



The air filter assembly on model 110000 & 120000 horizontal overhead valve Intek™ engines has been modified to create a more positive seal between the air filter and base. After extended use in the field some air filter mounting surfaces may deform slightly. To compensate for this irregularity a foam filter has been designed to fit on the bottom of the original air filter. If your engine has an original filter part number 498596 you can order the foam filter part number 273878 and stick it to the bottom of your air filter. The foam filter comes with an adhesive strip. To order a new air filter assembly complete with filter, foam pre-cleaner, and foam bottom use part number 696990.

IMPROVED DATE CODE STAMPING PROCESS

The location of the model type and date code of the horizontal Intek™ engines has changed. This information is now on the air cleaner side of the valve cover. The stamping process is accomplished by using a hydraulic bar stamp press to stamp the numbers and letters on the valve cover. This new process makes it much easier to read the model type and date code on applications such as pumps, vacs, and blowers.

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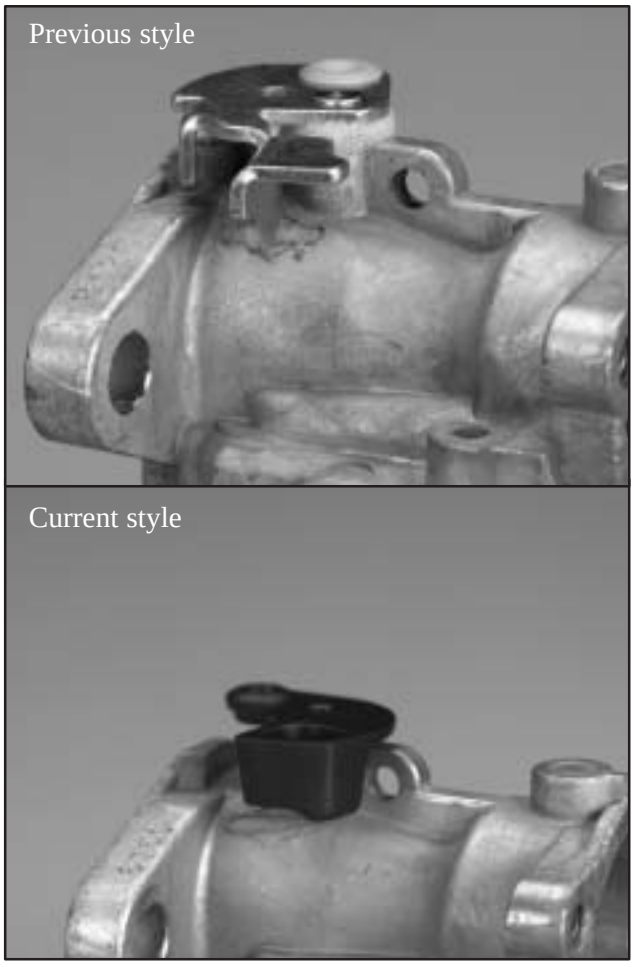
CHANGE IN THROTTLE LEVER AND SHAFT

The throttle lever and shaft on the LMS single circuit carburetor typically used on walk-behind rotary lawn mower engines, has been redesigned to improve throttle plate response from the idle to the wide open throttle position.



BRIGGS & STRATTON

MASTER PARTS PRO™

This new program, like the companion Master Service Technician Program, is designed to help you turn your parts counter into a profit center.

How? By providing the sales and marketing tools to make your parts sales area, and the person or personnel who staff it, more proactive in creating an attractive, knowledgeable part sales area. The Master Parts Pro Program will test counter personnel for their knowledge in identifying what the customer wants, and assist them in selling the customer associated products customers may not realize they need, or are not aware of.

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NEW PISTON AND RINGS FOR MODELS 280000, 420000 AND 460000 ENGINES

There have been changes made to the pistons and rings on models 280000, 420000 and 460000 engines.

These new components reflect a decrease in ring thickness for improved cylinder bore conformability, engine performance and emissions.

Service Note: Due to the change in ring thickness a ring expander part number 19340 or equivalent must be used to remove and install piston rings.

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VANGUARD 3/LC cylinder liquid cooled BRIGGS & STRATTON

SERVICE BULLETIN

TO **All Authorized Briggs & Stratton Daihatsu Dealers**

No. 7
DATE 7/00
FILE IN 0729 Binder

SUBJECT **Oil Fill Procedure**

MODEL(S) **All Vanguard Three Cylinder Liquid Cooled Engines**

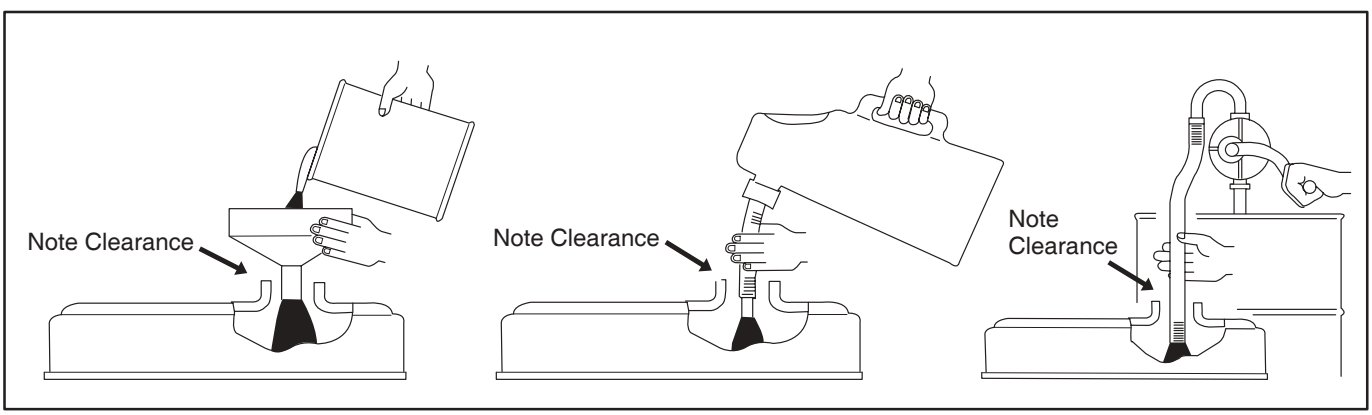
It has come to our attention that severe engine damage may occur if the proper oil fill procedure is not observed. If a large quantity of oil is added too quickly to the engine, the valve cover chamber can fill with oil and overflow into the breather tube and enter the intake manifold. When the engine is started, the oil is ingested into the cylinders which may result in hydraulic lock. To prevent this condition from occurring follow the procedure outlined below.

Oil Fill Procedure

1. Place equipment on level surface (engine must be level).
2. Remove dipstick to allow air to vent from crankcase while filing engine with oil.
3. Add oil slowly to prevent filling valve cover chamber with oil and overflowing into breather tube.

Note: Be sure to provide clearance between oil fill device (funnel, oil fill spout, etc.) and oil fill hole in valve cover to permit proper venting while filling. See examples below.

Oil Capacity(with filter) : 3.5 Qts. (3.3 Liters)



4. Replace dipstick.
5. Start and run engine at idle for approximately 30 seconds, then shut engine off. Wait 30 seconds and check oil level. Add oil , if required, to bring level to **Full** mark on dipstick. **DO NOT OVERFILL.**

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SERVICE BULLETIN

TO ALL AUTHORIZED SERVICE ACCOUNTS

No. 690
DATE 9/00
FILE IN Bulletin Binder

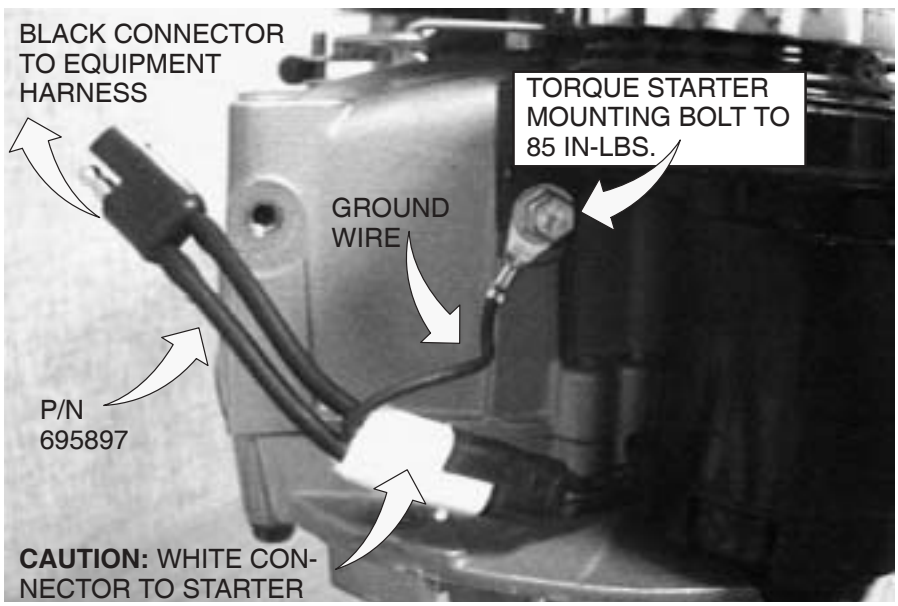
SUBJECT **Alternator Charging**

MODEL SERIES **Vertical Shaft Intek™ 110000 and 120000 and Quantum® 120000**
Date Code 00040400 to 00083100

We have received some reports that the alternator is not charging the battery of subject engines during normal operation. We have determined that this may be due to a potential grounding problem within the starter motor.

Should you encounter this complaint on subject engines with date codes 00040400 to 00083100, order P/N 695897 and install as shown below. Install **WHITE** connector to starter and **BLACK** connector to equipment harness. Install ground wire at starter mounting bolt. Torque to 85 in-lbs.

CAUTION: If harness is not installed as shown below, a dead short to the battery will result, causing damage to wiring, battery and/or equipment.


BLACK CONNECTOR TO EQUIPMENT HARNESS
TORQUE STARTER MOUNTING BOLT TO 85 IN-LBS.
GROUND WIRE
P/N 695897
CAUTION: WHITE CONNECTOR TO STARTER

File Briggs & Stratton warranty claim per normal guidelines. Enter Defective Part Reference Number **802** (Box 5); Defect Code **EF** (Box 6). Enter **5060** in lower right hand corner of claim (F/C, Box 14). This repair can normally be completed in 15 minutes or less.

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SERVICE BULLETIN

TO: ALL AUTHORIZED SERVICE ACCOUNTS

No. 691
DATE 10/00
FILE IN Bulletin Binder
Replaces SB 688

SUBJECT: **Briggs & Stratton Time Analysis Repair Guide**

Note: Underlined Text denotes revised information.

In response to requests from Authorized Briggs & Stratton Dealers for published standard repair times, we are pleased to announce the Briggs & Stratton Time Analysis Repair Guide (MS-6341). This guide may be used for repair estimates, shop tickets/scheduling, and for completing Briggs & Stratton Warranty Claims.

Although the repair times noted in this guide are not considered flat rate times, they do fall within our guidelines for warranty labor allowances. Therefore, when submitting a Briggs & Stratton Warranty Claim, it is suggested that this guide be referred to for appropriate labor times. In the event a repair takes longer than the published time, we do request additional information on the claim explaining the reasons for the extra time.

The repair times listed include:

- Diagnostic
- Cleaning/Testing
- Paperwork/Administrative (parts look-up, ordering, warranty claim, etc.)

Due to varying degree of times required to remove and replace an engine from the equipment, remove and reinstall times (R&R) were omitted, with the exception of shortblock repairs. Nominal R&R times are included in the repair times noted for shortblock repairs.

To use the guide, first go to the section for the engine you're working on, find the engine series across the top row and the repair operation along the left column. Find where the two intersect, and that will give you the repair time in hours and/or minutes.

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SERVICE BULLETIN

BRIGGS & STRATTON

TO ALL AUTHORIZED SERVICE ACCOUNTS

No. 693

DATE 4/01

SUBJECT Touch-N-Mow™ Starting System

FILE IN Bulletin Binder/ Repair Manual

MODELS 120000 Quantum® & Intek™ Vertical Shaft

The purpose of this bulletin is to alert Service Dealers of IMPORTANT safeguards, diagnostics, and overall service procedures unique to the Touch-N-Mow™ starting system, as featured in the 2001 Briggs & Stratton Update Seminar.

IT IS IMPORTANT FOR SERVICE DEALERS TO READ AND UNDERSTAND THIS SERVICE BULLETIN.

⚠ WARNING

Touch-N-Mow™ Starting System: If these instructions are not followed, traumatic amputation or severe laceration can result.

- ALWAYS disconnect spark plug, de-energize starter, lock and remove safety key BEFORE performing ANY service to the engine or mower.
- DO NOT attempt any maintenance or repairs to the Touch-N-Mow™ starter.
- NEVER assume starter is de-energized, even if key is in LOCK AND REMOVE position and/or removed from engine.
- BEFORE removing grass or other debris from under mower deck; BEFORE changing oil, air filter or spark plug; BEFORE removing blade for servicing; BEFORE performing any other service to engine or mower; BEFORE transporting mower – ALWAYS DE-ENERGIZE TOUCH-N-MOW™ STARTER.
- ALWAYS lock and remove safety key and store in safe place until next use. The safety key is designed and intended to be removed from engine when not in use. Removing key will prevent unsupervised or unexpected starting of mower by children or unsuspecting adults. The safety key must be in locked position before it can be removed.

TROUBLESHOOTING TIPS

Before servicing starter, verify if a problem exists with Touch-N-Mow™ starter. Equipment controls, cable travel, or a general engine starting problem may be perceived as a starter problem.

4. Check control cable travel (Fig. 1). If **not** within specifications, cable may need to be replaced. There are no adjustments for cable travel. The control cable is supplied and warranted by the equipment manufacturer. Safety key must be in the RUN position when measuring cable travel. Note position of control handle.
5. If cable travel **is** within specifications, attempt to start engine using the rewind starter. Note the safety key must be in the RUN position, and the starter control button must be depressed while pulling bail, or blade control handle, when using rewind starter.
6. If engine fails to start using rewind starter, trouble-shoot fuel, air intake, and ignition systems, etc. to determine reason for starting problem. Specifically, check ignition ground wire routing to stop terminal, mounted on Touch-N-Mow™ starter. If stop wire is pinched between starter housing and cylinder the engine will not start. **Never start engine with ground wire removed from stop terminal.** This will damage the starter.
7. If engine starts with rewind starter, allow engine to warm up before releasing bail. A loud ratcheting/winding sound **should** be heard during shut down. This is normal and confirms the power–spring of the Touch-N-Mow™ starter is being energized.
8. If a loud ratcheting/winding sound **is not** heard during bail release, and cable travel **is** within specification, the problem is in the Touch-N-Mow™ starter. The entire starter will need to be replaced. There are no parts serviceable on the Touch-N-Mow™.
   WARNING: See *"REMOVING STARTER"* before attempting service.
9. If a loud ratcheting/winding sound **is** heard during bail release, attempt to re-start engine using Touch-N-Mow™ starter.
10. If the Touch-N-Mow™ starter **does** crank the engine, the problem **is not** with the Touch-N-Mow™ starter.
11. If the Touch-N-Mow™ starter **does not** crank the engine, and cable travel **is** within specification, the problem **is** in the Touch-N-Mow™ starter. The entire starter will need to be replaced. There are no parts serviceable on the Touch-N-Mow™. **WARNING: See *"REMOVING STARTER"* before attempting service.**

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REMOVING STARTER

BEFORE removing the Touch-N-Mow™ starter, ensure the starter is not energized by manually de-energizing it. (Fig. 2)

1. To manually de-energize the starter, disconnect spark plug wire, turn safety key to the RUN position, and manually actuate the starter control by pulling the actuating arm. (See Fig. 2)

   WARNING: ***Engine will crank over and blade will rotate when manually de-energizing starter.***

2. Disconnect ignition stop wire, remove equipment control cable, and remove starter from engine.
   Note: A Tamper-proof T-30 Torxt driver (B&S P/N 19518) or equivalent is required for removal.
3. When replacing starter, verify the stop switch wire is properly routed and grounded. **Failure to properly attach stop switch wire to stop terminal on starter will result in damage to the starter.** If wire is pinched or grounded, engine will fail to start.

WARRANTY

The Touch-N-Mow™ starter has no serviceable components. If failure occurs the entire unit must be replaced. All Touch-N-Mow™ starters replaced under warranty must be authorized by your Central Sales & Service Distributor. All warranted starters are required to be returned to the factory, with an original, printout, or photocopy of the warranty claim. See Briggs & Stratton Warranty Policies & Procedures (MS-2860) for return address information.
DANGER: Do not return starter in an energized state.

Normal wear and tear – The Touch-N-Mow™ starter contains various metallic wear components. It is **not** unusual for small amounts of metal filings/powder to accumulate on mower deck over time. This is normal wear and tear, and does not indicate a problem with the starter, nor will it be considered a warranty defect.

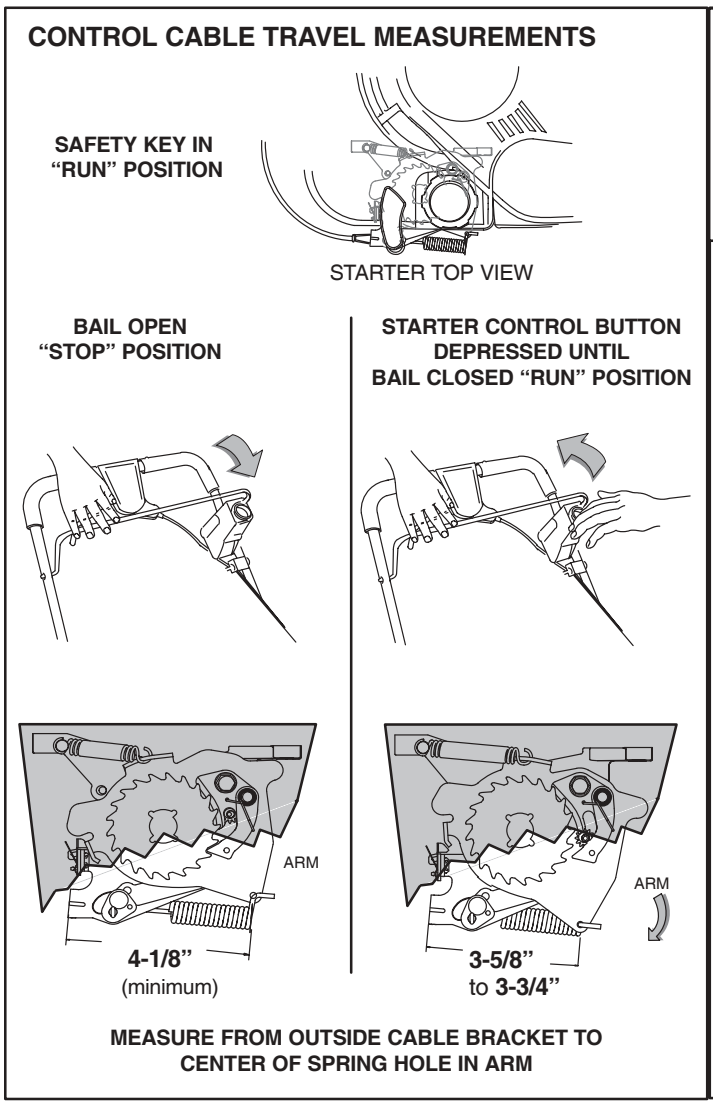
CONTROL CABLE TRAVEL MEASUREMENTS
SAFETY KEY IN "RUN" POSITION
STARTER TOP VIEW
BAIL OPEN "STOP" POSITION
STARTER CONTROL BUTTON DEPRESSED UNTIL BAIL CLOSED "RUN" POSITION
ARM
ARM
4-1/8" (minimum)
3-5/8" to 3-3/4"
MEASURE FROM OUTSIDE CABLE BRACKET TO CENTER OF SPRING HOLE IN ARM

Fig. 1

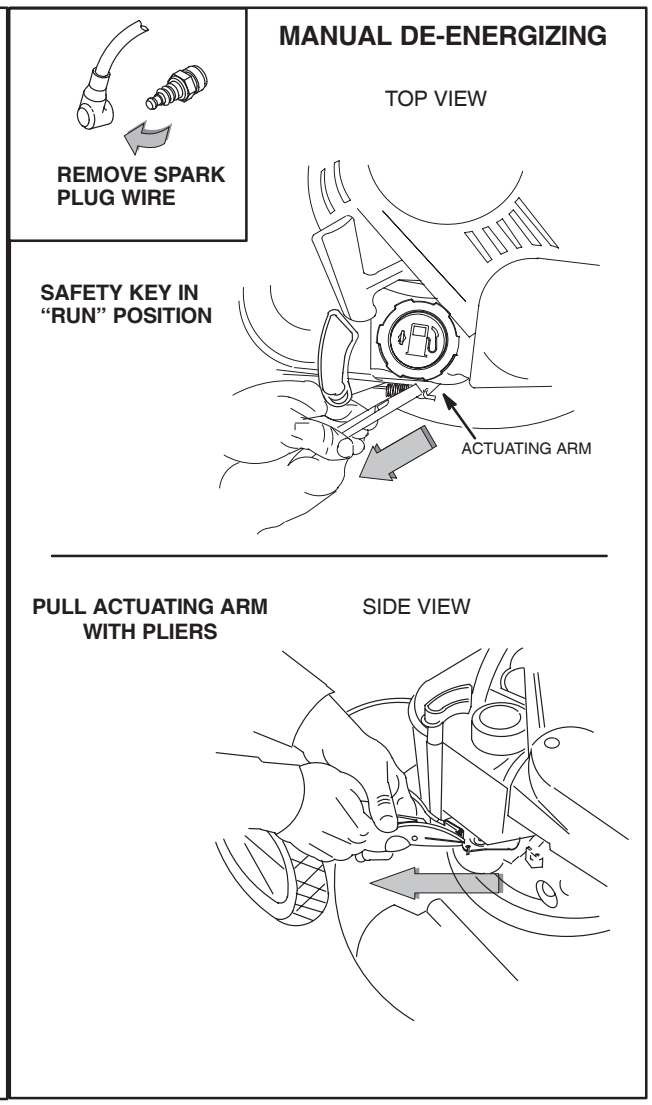

Fig. 2

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SERVICE BULLETIN

TO ALL AUTHORIZED SERVICE ACCOUNTS

No. 694

DATE 5/01

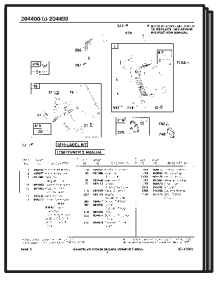
SUBJECT ILLUSTRATED PARTS LIST NEW FORMAT

FILE IN Bulletin Binder

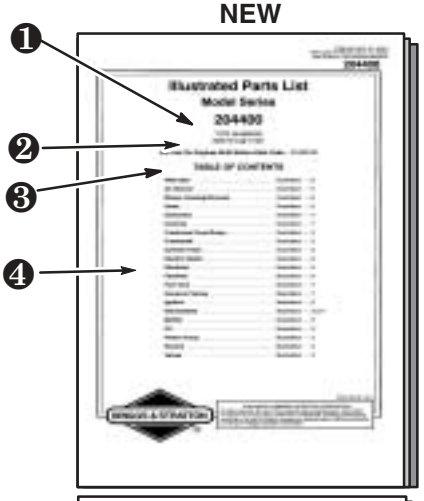
MODELS ALL

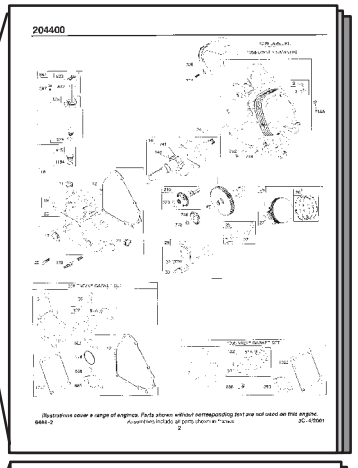
We have changed the format of the Illustrated Parts List.

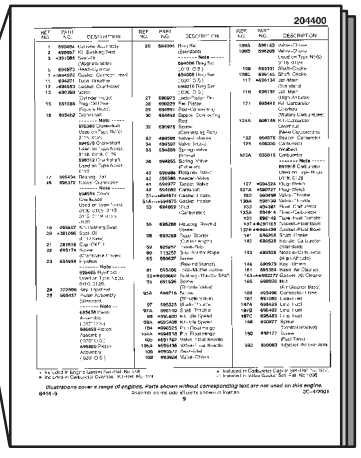
OLD



NEW







As more attention is given to electronic parts look up, it has become necessary to change the format of the Illustrated Parts Lists. Our goal, to allow the user to have more parts available at one glance, and spend less time paging through to find the part needed. New highlights are outlined below:

❶ **General Model Series –** Each Illustrated Parts List is still model specific, based on the first four digits of the model number. There is no longer a range listed.

❷ **Type Numbers –** are now presented in a range format instead of individually listed. If the type number is not within the range, a different parts list may be required.

❸ **Date Code –** To aid in determining the correct parts list for an engine, based on engine build date.

❹ **Table of Contents –** Offers a quick search to find the part group location. A listing of primary engine components refer to the page which illustrates that group.

❺ **Exploded Engine Views –** Allows an easy glance at the associated service parts, and location of the part required.

❻ **Service Part Numbers in Sequential Order by Reference Number –** All parts are *listed together* by reference number. Once reference number is known, simply turn to the numeric listing at the back, and find the associated service part.

This new format shrinks the page count by almost 30%, substantially reducing the amount of microfiche cards, as well as the size of each individual parts list. The revisions should be completely implemented within the next few months.

Please Note: Future format changes may still occur on an as needed basis.

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SNEAK PREVIEW

BRIGGS & STRATTON 5 HP OUTBOARD MOTOR

Briggs & Stratton is developing a low cost gasoline outboard motor to target the needs of both current boat owners and those entering the recreational boating market.

The 5 hp (3728.5 watt) Intek™ powered motor will allow first-time boaters an affordable alternative to conventional marine products. Distribution channels will include the Briggs & Stratton dealer network, mass retailers, and marine dealers. Briggs & Stratton dealers will provide service and warranty work.

The Briggs & Stratton Marine Motor has been designed to provide reliable power for small boats rated to accept a 5 hp (3728.5 watt) outboard. Based upon current testing, production is slated for the spring/summer of 2002.

FEATURES

- Intek™ model 12Y600 - 5 hp (3728.5 watt)
- 4 cycle OHV
- Emission compliant
- Over speed protection
- Gear box features forward, neutral and reverse
- Push button stop w/safety lanyard
- 3-blade aluminum propeller
- Weight: 51 lbs. (23.13 kg)

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